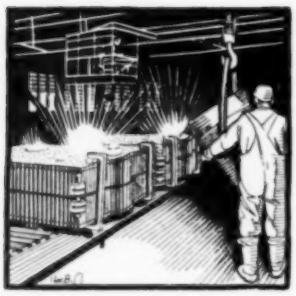


THE FOUNDRY

for January

Devil DANCING

EXCORIATING devils was a savage practice. Fanatic frenzy built prestige for medicine men of Indian tribes and may have had some effect in working up the proper atmosphere for inter-tribal wars. Stimulated by intense propaganda, patriotic fervor may have been effectively promoted by atrocity tales during the World War, although the procedure is dimly reminiscent of the same savage practice. Building an attitude of hatred and mistrust for an individual, a class, a nation or a cause is a weapon of war. Devil dancing has no place in civil life. It is despicable and *dangerous* in American governmental procedure.

NRA Tom-Tom BEATERS

PERHAPS some thought a certain amount of name calling and abuse was necessary to stir the lethargy of manufacturers at the inception of the NRA movement. Picturesque epithets so eagerly headlined in the daily press invariably were aimed at the industrial representatives in the partnership between government, management and labor. The habit grew. Early contact with minor representatives of the administration in Washington demonstrated the low valuation placed upon good faith, honor and even integrity of industrial leaders in America. Of course the basis of this low estimate may have been inherent with some of the more socialistically minded men called to the colors of NRA, but the beating of the tom-toms increased the fervor. Bickering and mutual recrimination among competitors, unaccustomed to any vestige of co-operative action gave to those pre-inclined to condemn, the evidence they sought to support a verdict of conviction against industry at large. Every case of chiseling or labor oppression, small as it might be was spread broadly over all industry. The best were loaded with the sins of the worst. Industry's friends were futile and ineffective. No advocates nor even disinterested friends from the manufacturers' side, rose to answer the war cries of the medicine men, since industry believed this to be a peace council and not a war dance.

Time to Change TACTICS

NOW that practically all industry is under codes and the success or failure of the entire planned economy movement is in the balance, it is time to reaffirm the President's original partnership offer and to stop the unwarranted propaganda that by inference impugns all industry and all manufacturers. Anyone knows that class, race, religious or national generalizations are unjust. It is just as unfair to state or imply that manufacturers are cheaters or that their motives are selfish and unfair. Anyone who has any semblance of acquaintance with industry knows that motives of the highest nature usually govern. Those who have watched from the close sidelines the struggle for survival during the past four years know that practically all heads of industrial enterprises have sacrificed to the limit every personal possession in physical, mental and material resource to keep their various enterprises afloat. In practically all cases they have done this for the future of their stockholders, associates, creditors and employes. The rousing of class hatred against these men, linking them with criminals and gangsters, calling them dullards and false leaders and all the claptrap of devil dancing must stop. The President says:

"Under the authority of this Congress, we have brought the component parts of each industry together around a common table, just as we have brought problems affecting labor to a common meeting ground. Though the machinery, hurriedly devised, may need readjustments from time to time, nevertheless I think you will agree with me that we have created a permanent feature of our modernized industrial structure and that it will continue under the supervision but not the arbitrary dictation of government itself."

If this be the future, name calling by politicians is out of order and the disdainful vaporing of cloistured academic theorists should cease. Industry must be self governing under the codes.

Fig. 1—Molds are poured in batches as they accumulate on roller conveyors extending from the battery of molding machines to the shakeout stations

Secures Uniformity in Composition

Three or four charges of iron tapped from cupola into a single 2-ton ladle

By PAT DWYER

TO THE uninitiated possibly all foundries present the same general appearance inside and outside, places where metal is melted and poured into sand molds, and yet strange as it may seem, if one was to tour the United States he would not find two foundries exactly identical either in building and equipment, or in methods of operation. Quite true, he would find many bearing a close family resemblance, but even as with the average human family, he would find each member displaying individual characteristics. While conforming in the main to what has come to be recognized as standardized construction and operation, the Fostoria, O., gray iron foundry division of the Electric Auto-Lite Co., Toledo, O., has developed many interesting features in the melting, molding and cleaning departments.

Erected first about 12 years ago at the northern outskirts of the town, the original building has been extended on several occasions in length and width. At present the section housing the molding and coremaking activities and extending north and south, is 500 feet in length and 160 feet in width, divided into four 40-foot bays. The cleaning room, 100 x 160 feet, extends all the way across the south end of the

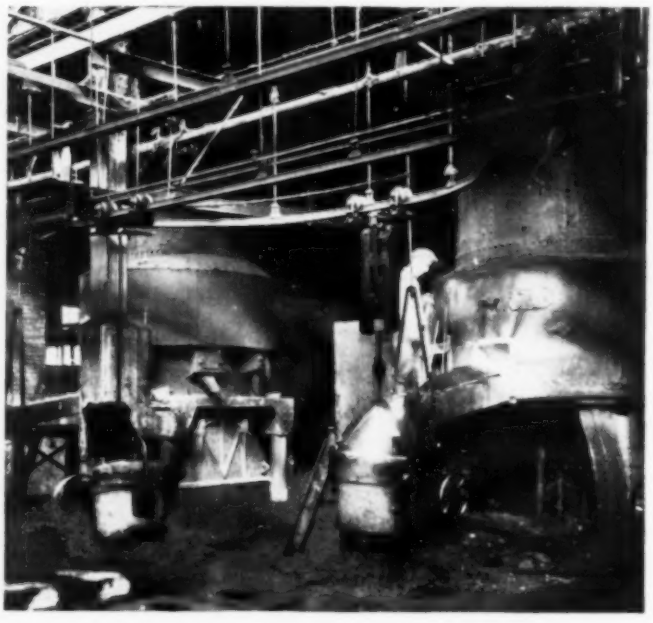


Fig. 2—Each of the twin cupolas is operated continuously all day on alternate days

main building. The core room occupies approximately half the length of the east bay and approximately half the west bay houses a machine and finishing shop, pattern shop and laboratory.

Ample light falls on the floor from windows extending to the eaves from a point near the floor line. Additional light enters through large full length windows in the outside member of the *A*-type roof over the two central bays. It is claimed that this type of roof also facilitates ventilation of the building. In cold weather the building is heated by air circulated through steam heated coils. Special boiler equipment is maintained for the purpose.

Cupola Lining Has Been Reduced

Metal is melted in two cupolas originally lined to 66 inches which occupy a position in the second bay from the west and an equal distance from each end of the shop. Melting is carried on continuously from 8 a. m. to 4 p. m. and for that reason the cupolas are operated alternately. While one is in blast the lining of the other is repaired. Blast is supplied by a blower made by the General Electric Co., Schenectady, N. Y., and attached in a suitable manner to deliver air to either of the cupolas as required. Through a mechanical adjustment the blower may be arranged to deliver air in widely varying volume. If necessary, further adjustment of the volume at any time may be secured through gates in the main blast pipe. Manner in which cupola operation has been adapted to meet lower production schedules in the past few years presents many interesting features.

Original lining diameter of each cupola has been reduced from 66 to 36 inches, but the restriction extends only a few feet above the melting zone. The remainder of the lining up to the charging door has not been changed. The result of course is a greatly exaggerated form of bosh construction. The original charge of 2000 pounds of iron has been reduced to 1000 pounds. Any person familiar with cupola charging will realize immediately that a 1000-pound charge of iron, with the accompanying small amount of coke will not form a complete or uniform layer in a 66-inch diameter circle, even if the charge were placed carefully by hand. In this particular instance the charge is dropped from a bucket and does not spread out to any extent.

Fig. 3—A charging crane lifts the material from this stock yard and deposits it in the cupola

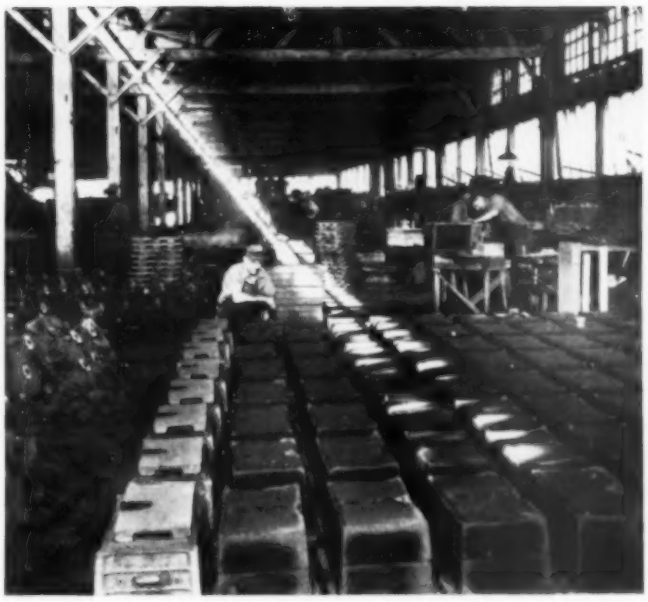


Fig. 4—Approximately 3000 manifolds per day are molded and cast in this bay

Modern Charging Controls Variables

In effect the method of charging corresponds to that in vogue 40 or 50 years ago and still practiced to some extent by old veteran foundrymen who see no reason for changing a system that gave them satisfaction. This observation is not to be construed as an adverse reference to the present practically universal method of charging the materials in a cupola in layers. In addition to meeting common sense requirements, the method is in line with modern development where the sequence of operation in the production of castings has been divided and subdivided with a view of bringing each operation within the capacity of unskilled, or comparatively unskilled help.

Practically any workman or group of workmen may be trusted with the job of charging a cupola where the layer method is observed. The hazard of miscalculating the relative amounts of iron, coke and limestone, or of placing them in improper order, is reduced to a minimum. Only a highly skilled and experienced melter may be

Fig. 5—A combined sprue and gate is placed in each pig mold before it is filled with over iron

trusted with the job of securing satisfactory melting conditions where the materials are charged in what may be termed a miscellaneous manner.

In the present instance the possible chance of error in making up the charges is obviated by assembling the materials for each charge in a steel bucket or container. This bucket is introduced through a large charging door in the side of the cupola and the entire contents dropped as a unit by releasing the bottom of the bucket. At only one stage is there a complete split of coke between the iron charges. This is to cover the shut down period from 11:30 a.m. to 12 noon. The miscellaneous combination of materials settles down slowly on account of the restricted area in the melting zone, but the molten iron coming from the spout shows a temperature of approximately 2800 degrees Fahr., and a practical uniformity in chemical and physical properties as attested by laboratory tests taken at 2 or 3 hour intervals during the progress of the heat each day. The foregoing factors would seem to indicate that while the method of charging may be regarded as unorthodox to some extent, it yields highly satisfactory results, and in the final analysis of any practical foundry operation, results constitute the only feature worthy of consideration.

Crane Handles Raw Materials

Raw materials are stored in a yard outside the building served by a railroad track in the center. A 5-ton crane operating on a runway which gives access to the entire yard unloads the materials from the railroad cars, piles them according to classification and each day conveys designated amounts to a slanting platform above a roller conveyor at the ground level. The charging bucket resting on the conveyor is moved to position in turn under those sections of the slanting platform containing the pig iron, scrap iron, coke and limestone. A man standing on the platform slides the required amount of each item into the bucket, 200 to 300 pounds pig iron, 20 pounds high silicon pig iron, 300 to 400 pounds return scrap and the remainder outside scrap, 150 pounds coke and 30 pounds limestone. An automatic scale checks the amount of each item.

Materials in the yard fluctuate in chemical and physical characteristics from day to day, due to many factors including market quotations. Cognizance is taken of this feature when issuing instructions for making up the charges. Anticipated analysis of the iron in the castings must approximate: Silicon 2.75 per cent; sulphur 0.095 per cent; manganese 0.54 per cent; phosphorus 0.15 per cent; total carbon 3.40 per cent. Iron to meet this analysis may be produced from several possible combinations of pig iron, gray iron and steel scrap. The plant metallurgist appraises the material on hand each day and issues instructions accordingly.

Two Men Handle Cupola Charges

The charging bucket is handled by a hoist suspended from a monorail which extends from a point above the conveyor to the second cupola. The trolley may be switched to either cupola as required. The operator travels in a cab attached to the hoist and the bucket in elevated position is close to the end of a long jib which projects into the cupola. In practice one bucket is on the conveyor receiving the charge while the second bucket is in transit to and from the cupola. Two men easily handle the present daily charge of 40 tons. The charging floor is served by an elevator for miscellaneous purposes and also as emergency equipment in connection with charging cars in the event that anything should go wrong with the regular charging machine.

Silica stone from the Cleveland Quarries Co., Cleveland, is used for lining and patching the cupolas. Stone for lining is supplied cut to the shape of regular cupola (*Please turn to page* 35)

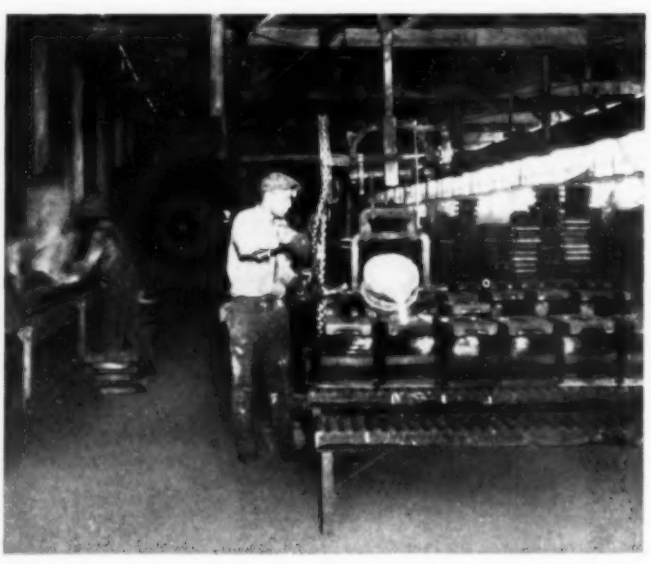


Fig. 6—Small castings are poured by a single operator with a geared ladle suspended from a monorail

Check Reduces Casting Losses

Systematic method of handling records is best cure for the bad castings evil

By PAUL R. RAMP

DEFECTIVE or bad castings constitute one of the most damaging items in the operation of a foundry. True they represent an expensive scrap value, but they are a source of trouble to every person connected with them. They increase the cost of operation, demoralize the production schedule, injure the firm's reputation and create dissatisfied customers.

A systematic method of handling it daily is the only thing that will cure the bad casting evil. Every foundryman expects a certain percentage of bad castings. If the volume remains between 3 and 5 per cent he does not put forth any special effort to reduce it. He includes this anticipated loss in his estimates, accepts it in his costs and then, in some instances, wonders why his competitor is able to under bid him.

Some foundrymen have claimed a 100 per cent good casting record for a short period, but as periods of this kind usually are decidedly short, it is not necessary to dwell upon them. However, with proper methods of supervision and inspection it is possible to reduce the bad casting record in the majority of foundries from 40 to 50 per cent. What is considered a normal loss of 5 per cent may be reduced to 2.5 or 2 per cent. The average foundryman does not devote sufficient time and thought to this subject.

Slight Reduction Make Large Saving

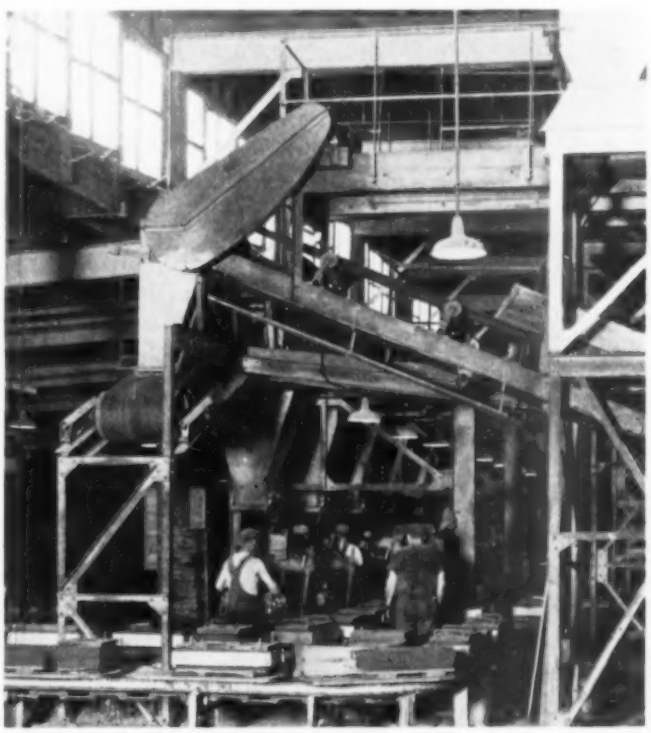
For example on a production of 400 tons per month with a sales value of $140 per ton, or $56,000, a loss of 5 per cent means a loss of $2800 per month or $33,600 per year. If this loss could be reduced to 3 per cent the saving would amount to $1120 per month or $13,440 per year. Similar proportionate savings may be effected on any tonnage and any casting price. A 1.00 per cent reduction of casting loss on a 400-ton output at $120 per ton means a saving of $480 per month or $5760 per year.

The claim may be advanced that only the profit is lost, but in the writer's opinion the expense of producing a bad casting and preparing it for remelting, etc., is equal to the sales value of a good casting. The sales value of a casting is based on the difficulty of production, therefore the more difficult the casting is to make, the higher the bad casting loss. Conversely a greater saving is possible on the difficult or high priced casting, than on others.

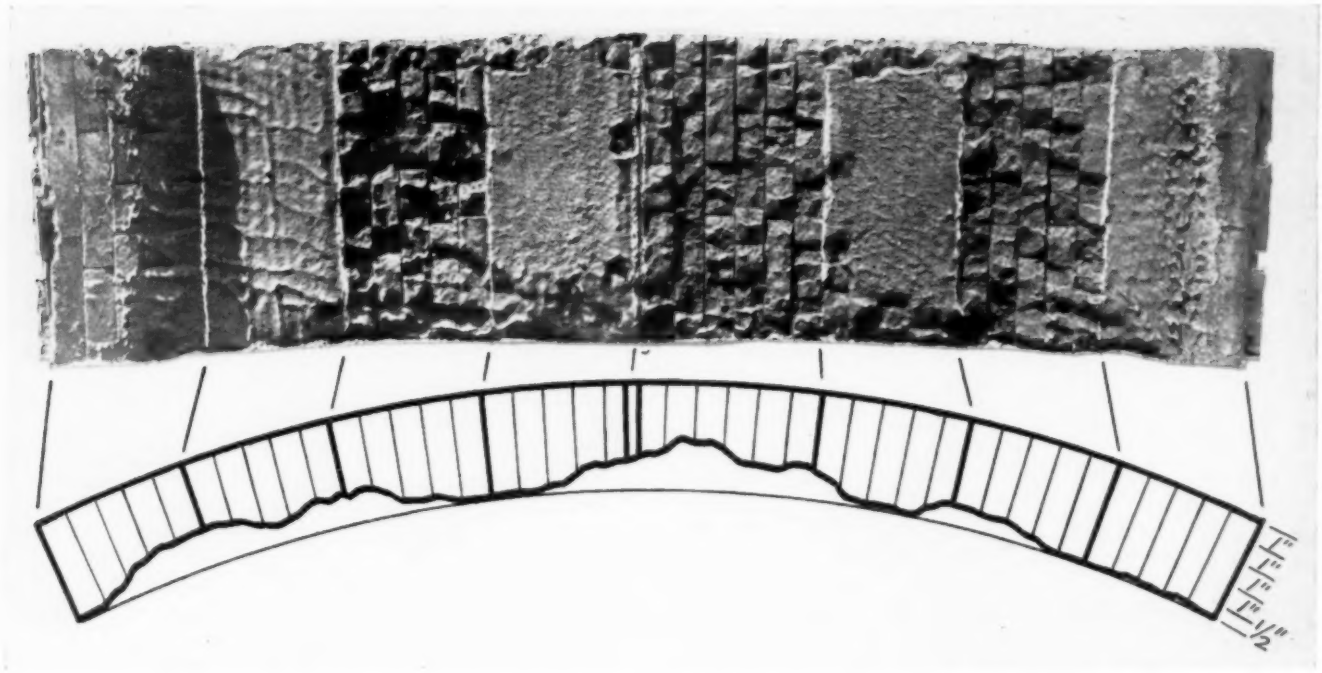
Three Classes of Castings Produced

Three classes of castings are produced in the foundry: Perfect castings; imperfect but acceptable castings; scrap castings. These three classes also might be described as: Healthy castings; sick castings; dead castings.

The proper remedy for reducing the number of dead castings is to concentrate on the sick rather than on the dead. We may bury the dead, but if we cure the sick, we shall have no dead. Usually the dead ones are the result of a long period of cast- (*Please turn to page* 36)



A complete daily record of defective castings will assist in eliminating unnecessary losses



Arrangement of alternate panels in recommended service test of two types of bung brick

Develop Tests for Bung Brick

Panels must be sufficiently wide to prevent failure in one affecting bricks in another

AN ECONOMICAL method of determining accurately which of the available types of fireclay brick is most satisfactory to air furnace operation is desirable and helpful to the foundryman operating that type of melting unit. With that fact in mind, the General Refractories Co. laid out an elaborate testing program some years ago, which used the available laboratory spalling tests; called for, if necessary, the development of new laboratory tests, and included extensive work in the field. Preliminary reports from the field showed the available laboratory tests unreliable and a new test, more closely simulating service conditions, was devised and tried. While generally satisfactory, that test proved more expensive than actual service tests, so that laboratory procedures were discarded and the program carried on and completed in the field.

These field tests were made on a conventional air furnace having 150 square feet of hearth and melting one 22-25-ton heat a day. The furnace is fired with powdered coal through two circular burner openings and heats are melted down at the rate of about 3 tons an hour. The bungs, when laid up, are about forty 2⅞-inch courses wide (parallel to the width of the furnace) and 31 inches deep (parallel to the length of the furnace). The front edge of the first or No. 1 charging bung, which is nearest the burner, is 36 inches from the burner wall. Four consecutive bungs are removed singly for charging. During the testing program the testing bungs are removed about 1 hour after the heat is tapped and allowed to rest on the floor another hour while the furnace is charged. When the charging is completed the bungs are placed on the furnace, usually resting lightly on the conical peak of the charge, where they remain until the furnace again is lighted.

Under these typical operating conditions, four methods are available by which the operator can compare the quality of a new bung brick with that of the type regularly used. The best method of course, is that which gives the operator maximum dependable (*Please turn to page* 40)

Compiles Jobbing Shop Rate Data

Established figures on variety of castings indicates that 90 per cent may be covered

By R. E. RISLEY

LABOR cost control, always a major industrial problem, is more important than ever under present economic conditions. Where a standard foundry product is made in quantities, control has been effected by piece work, task work, or wage incentive systems wherever practical. Also by scheduling operations and budgeting productive and nonproductive labor costs.

Labor cost control certainly is no less important in the foundry handling jobbing work, but the problem presents greater difficulties. The first step in the solution involves the development of a practical method of setting equitable allowances for the performance of productive tasks. Determination by comparison with previous performances on similar jobs is difficult due to the varied nature of the work and the small quantities. Systems involving time studies of the individual job have been attempted in the jobbing foundry, but the cost of setting allowances by this method has exceeded the savings effected.

Establish a Unit System

A method, a part of the routine operation in the foundry of the Goslin-Birmingham Mfg. Co., Birmingham, Ala., has proved successful on various lines of castings including cotton compress equipment, sugar mill and refinery equipment, filters, sluice gates and general heavy jobbing work. Allowances for the performance of operations are expressed in terms of units, a unit representing a normal minute of work. This allowance is known as the standard for the operation and is computed by the use of standard data.

Standard data are those used in the computation of standards. Values are expressed in units (minutes allowance) since under similar conditions the time required for an operation does not vary, as wage scales vary. If desired, the standard for an operation may be converted to a cash allowance based on the existing wage scale.

The accompanying table for drag, cope and pattern values illustrate the form in which standard data appears. They include data covering bench molds hand rammed, using snap flasks with no bands, with wood patterns mounted on boards. Each drag value shown covers work inherent to the making of a drag of that size: Place flask, sand in, pein, level, butt off, strike off, level and place bottom board, etc. The same applies to cope values and pattern values. Extra sprues or risers, core setting, whistlers, lugs, chills, etc., are considered as miscellaneous items. Separate values are developed to cover them.

No standard form is used in the assembly of data. Each class is considered a problem in itself and the resultant (*Please turn to page* 41)

Standard Data for Drag, Cope and Pattern Valves

DRAG

Depth inches	Area Classification A	B	C	D	E	F
2	0.75	0.80	0.90	1.00	1.10	1.25
3	0.80	0.90	1.00	1.10	1.25	1.40
4	0.85	0.95	1.05	1.15	1.35	1.55
5	0.90	1.00	1.15	1.25	1.45	1.70
6	0.95	1.05	1.20	1.35	1.55	1.80
7	1.00	1.15	1.30	1.45	1.70	1.95
8	1.10	1.20	1.35	1.55	1.80	2.10
9	1.15	1.25	1.45	1.65	1.90	2.30
10	1.20	1.30	1.50	1.70	2.00	2.40

COPE

Depth inches	Area Classification A	B	C	D	E	F
2	1.45	1.50	1.60	1.75	1.90	2.10
3	1.55	1.65	1.75	2.10	2.40	2.60
4	1.65	1.75	1.90	2.50	2.80	3.10
5	1.85	2.10	2.30	2.80	3.00	3.40
6	2.00	2.50	2.70	3.00	3.20	3.60
7	2.30	2.70	2.90	3.20	3.40	3.90
8	2.60	2.80	3.00	3.30	3.60	4.20
9	....	....	....	....	....	....
10	....	....	....	....	....	....

PATTERNS

Draw inches	Area Classification A	B	C	D	E	F
0	0.70	0.70	0.75	0.80	0.85	0.95
¼	0.80	0.85	0.90	1.00	1.10	1.20
½	0.90	0.95	1.05	1.15	1.25	1.40
1	1.05	1.10	1.20	1.30	1.45	1.65
1½	0.15	1.25	1.35	1.45	1.60	1.85
2	1.25	1.35	1.45	1.60	1.80	2.00
2½	1.35	1.45	1.55	1.70	1.90	2.20
3	1.45	1.55	1.65	1.80	2.00	2.30
3½	1.55	1.65	1.75	1.95	2.20	2.50
4	1.60	1.70	1.85	2.10	2.30	2.70
5	1.75	1.85	2.00	2.30	2.50	2.90
6	1.90	2.00	2.20	2.50	2.70	3.10
7	1.95	2.10	2.30	2.60	2.90	3.30
8	2.00	2.20	2.40	2.70	3.00	3.40

Chromium Alloys Steel Castings

Steels low in chromium have physical properties adapted to many purposes

By J. H. CRITCHETT

THE steadily increasing part that alloy steel castings are playing in the steel castings industry is illustrated in Fig. 1, where one curve shows the total production of steel castings, since 1921, the second the production of alloy steel castings, and the third the percentage relationship which alloy steel castings bear to the total production of steel castings.

It will be noted that the total steel castings production quickly reached a normal value and held fairly steadily for several years, until the present economic difficulties developed. On the other hand the percentage of alloy steel castings climbed steadily, making a new high each year. There was a slight drop in percentage in 1929-30, but the progress then was resumed even in the dull years following. From only 4 per cent the proportion of alloy steel castings has increased to over 17 per cent and shows every indication of going further.

Balance Advantages With Cost

Rapidly increasing importance of alloy steel castings is based on the ever-increasing tempo of production and the consequent demand for machinery and structures capable of withstanding severe duty, better understanding of problems of heat treating on the part of the foundry personnel and more general equipment of foundries to do that kind of work. Once heat treatment became applied generally to all plain carbon steel castings, analyses were found for alloy steel castings which fitted readily into steel foundry practice. The increased cost of the alloy steel casting is returned many times to the purchaser through the better service which he obtains. The steel founder has a wide range of choice in alloying elements. Advantage of special properties must be balanced against the cost of production.

Chromium is used in conjunction with numerous other alloying elements which supplement the advantages of chromium taken singly. Among these are nickel, molybdenum, vanadium, manganese, silicon and others. One or more augment the mechanical or develop special chemical qualities in the steel. The complex steels do not come within the province of this article, which deals only with plain chromium steels. In considering plain chromium steels there is a tendency to lose sight of the excellent mechanical properties that may be obtained with that element alone, in the light of the more spectacular behavior of the somewhat higher chromium steels, with regard to corrosion.

The first part of this article deals with castings containing 1 to 3 per cent chromium, used for structural parts. The second covers a chromium content of from 4 to 7 per cent, used where both structural and certain corrosion requirements must be met. In the third part cursory mention is made of the special high-chrom-

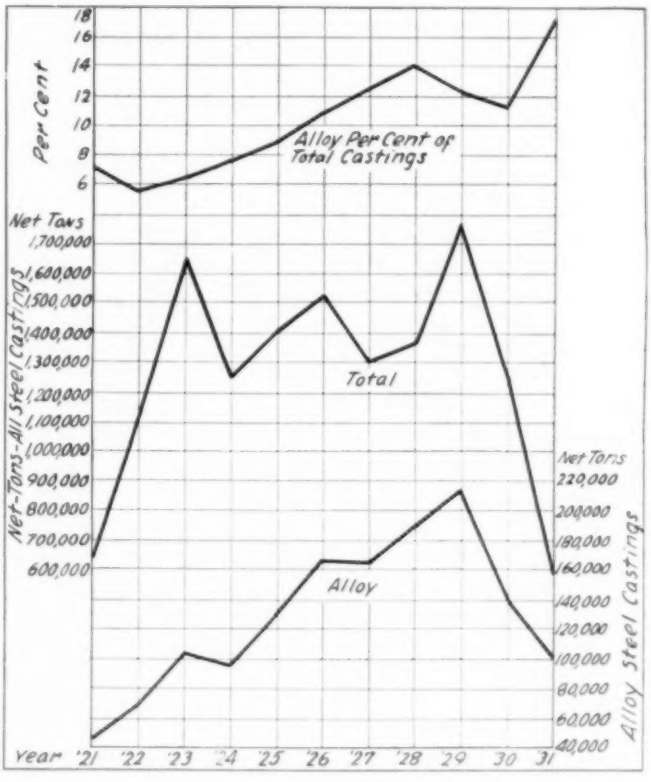


Fig. 1—Production of steel castings both alloy and total, from 1921 to 1931

ium corrosion-resistant steel castings.

Data set down in Table III illustrate physical properties obtained from plain chromium steel castings with ordinary heat treatments. The carbon, silicon and manganese of the five steels illustrated are sufficiently uniform so that from the point of view of analysis chromium is the variable.

The first is a plain carbon steel treated for the best combination of strength and ductility. The second illustrates the fact that by dropping the carbon slightly and adding a small amount of chromium, both the strength and ductility are raised. Often in dealing with alloy steels the metallurgist works from the carbon steel end and attempts to modify the carbon steel by alloy additions. He will get better results by considering the alloy combination first and adjusting the carbon to give the desired results. By this route, in general, maximum ductility will be obtained for a given strength, and by the simplest heat treatments. This fact is still further illustrated by the third steel in this group. Slightly lower carbon and higher chromium, would have shown equally high strength and better ductility.

The last two analyses in Table III are characterized by somewhat unusually high chromium content. The physical properties are good, the ductility high for steel of such high yield and ultimate strength. These steels are suited eminently to structural uses where resistance to abrasion is needed.

Table IV contains data on another type of low-chromium steel of the Cromansil variety. In this analysis the manganese and silicon are about 0.5 and 0.25 per cent, respectively, over that for plain carbon steel castings, and the chromium is held around 0.5 per cent. The steels

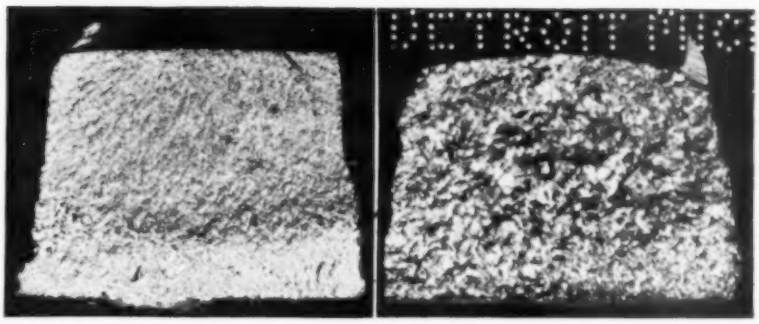


Fig. 2—Grain refining effect of nitrogen addition to 25 per cent chromium steel casting

are made easily and call for only a moderate alloy cost. They run freely and behave well in the foundry, and can be heat treated by ordinary air cooling methods. The ductility figures are exceptionally good for such high strength, better than would be expected of plain carbon steels liquid quenched.

The last four sets of figures in Table IV are for a Cromansil analysis containing a little vanadium to obtain grain refinement. The latter element does not materially affect the physical properties. The figures are given for that analysis heat treated in four different ways. While oil quenching gives slightly higher ductility values than air cooling, the improvement is hardly sufficient to warrant additional cost and bother for the oil-quenching method, except when rigid specifications must be met. By proper alloy combinations, steels can be produced whose properties are developed by simple, inexpensive methods of heat treatment.

Suitable for Many Uses

Only a few technical data have been given to illustrate the wide range of properties that can be obtained with chromium alone. Unfortunately, all the properties of a steel casting cannot be set down in a simple tabulation of figures.

The chrome steels with a combination of toughness and hardness are suitable for wear-resistant parts. In particular, the 3 per cent chromium grade is extremely suitable for rock-crushing equipment and dipper and dredge teeth. Chromium imparts a unique depth-hardening quality which simplifies heat treatment and insures good uniform properties throughout massive sections and throughout castings of greatly varying section.

Physical properties of steels of 4 to 7 per cent chromium content at room temperature are sufficiently well shown in Table I. Properties creating a new market for the 4 to 7 per cent chromium steels include: Strength at moderate temperature, noticeable increase in corrosion resistance, and resistance to scaling at moderate temperature. True creep strength figures are not available, but short-time tests indicate a safe load

Table I

Resistance of Chromium Steels To Corrosion

	Chromium Content of Steels, per cent				
	0.00	1.06	2.77	4.64	7.14
Test Solutions	Inches Penetration in 30 Days				
Hot Aerated City Water	0.20	0.030	0.010	0.009	0.011
Aerated Dilute HCl	0.025	0.022	0.008	0.005	0.004
Aerated NaCl Solution	0.012	0.009	0.007	0.007	0.008
NaCl Solution Aerated with H2S	0.023	0.010	0.005	0.004	0.003
Aerated Dilute H2SO4	0.024	0.020	0.013	0.010	0.007

Table II

Relative Oxidation Resistance

Sample.	Per Cent. Loss in Weight.
Ship Plate	34
Cast Iron	36
5.47 Cr, 0.11 C	20
6.0 Cr, 0.13 C, 0.90 Ti	11
6.8 Cr, 0.06 C, 0.69 Ti	2

in excess of 20,000 pounds per square inch at 800 degrees Fahr., and experience has shown satisfactory performance at even higher temperatures. Corrosion resistance of this class of steels is indicated by the test results of Table I, showing inches of penetration in a 30-day test.

While these steels cannot be compared with the higher chromium true stainless steels for corrosion resistance, the tabulation shows a worth-while increase in corrosion resistance with 3 per cent chromium or better in all tests, and a good increase in resistance against dilute hydrochloric acid, hydrogen sulphide aerated salt, and dilute sulphuric acid solutions.

The oxidation resistance of that type of steel has been confirmed sufficiently in practice to give assurance that it is commercially valuable for such service. The figures of Table II were obtained on samples held in an open muffle furnace at 1500 degrees Fahr. for four weeks and the percentage loss in weight then determined.

It will be noticed that 6 per cent chromium steel could be expected to have materially longer life than ordinary steel at this temperature. Addition of a fairly large amount of titanium still further increases the life of the plain chromium steel, and if the carbon is held low and a titanium addition made, the life is remarkably long.

Chromium steels 4 to 6 per cent without titanium addition may have a low elongation and reduction of area, depending on how the castings have cooled. This is due to the extreme air-hardening properties imparted by the chromium. Titanium almost entirely eliminates the air-hardening property so that the steels are relatively ductile as cast. Simple reheating to about 1650 degrees Fahr. with slow cooling still further increases the ductility and toughness to values comparable with low-carbon ordinary steel.

Sluggishness and poor foundry qualities, naturally to be expected from a steel with so much chromium and so little carbon, can be overcome by increasing the silicon above that usually employed. The added silicon apparently has no detrimental effect on the stability of this steel under corrosive conditions. Other elements are known to bring about the same effect as titanium, and these elements have a similar beneficial effect on other chromium steels than those containing 4 to 7 per cent chromium.

For the purpose of the present discussion, plain chromium cor- (*Please turn to page* 43)

Table III

Cast Steels of Low Chromium Content

Analysis, Per Cent				Physical Properties				Treatment* (temp. in degs. Fahr.)	
C	Mn	Si	Cr	Ultimate Strength lbs. per sq. in.	Yield Point lbs. per sq. in.	Elongation in 2 in., Per Cent	Reduction of Area, Per Cent	N.	D. *
0.32	0.82	0.33	....	77,000	43,000	32	57		
0.26	0.90	0.68	0.65	84,000	51,000	33	63	1650 A.C.	1550 A.C.
0.38	0.74	0.50	0.81	97,000	55,000	19	30	1650 A.C.	1250 A.C.
0.36	0.41	0.23	3.00	118,000	94,000	23	51	1650 A.C.	1250 A.C.
0.36	0.78	....	2.97	151,000	127,000	14	29	1650 W.Q.	1150 A.C.
0.36	0.78	....	2.97	142,000	122,000	15	34	1600 O.Q.	1150 A.C.
0.36	0.78	....	2.97	138,000	120,000	16	37	1500 O.Q.	1150 A.C.

*N. = normalized; D. = drawn; A.C. = air cooled; W.Q. = water quenched; O.Q. = oil quenched.

Table IV

Low-Chromium Steels of Cromansil Analysis

Analysis, Per Cent					Physical Properties				Treatment* (temp. in degs. Fahr.)	
C	Mn	Si	Cr	V	Ultimate Strength lbs. per sq. in.	Yield Point lbs. per sq. in.	Elongation in 2 in., Per Cent	Reduction of Area Per Cent		
0.37	1.49	0.46	0.52	....	117,000	73,000	20	48	1650 A.C.	1250 A.C.
0.39	1.38	0.57	0.63	....	124,000	75,000	21	49	Anl. 1650	1550 A.C. 700 A.C.
0.42	1.45	0.80	0.38	0.16	116,000	74,000	21	41	1650 O.Q.	1150 A.C.
0.42	1.45	0.80	0.38	0.16	116,000	74,000	19	43	1650 A.C.	1150 A.C.
0.42	1.45	0.80	0.38	0.16	105,000	73,000	26	49	1650 O.Q.	1450 A.C.
0.42	1.45	0.80	0.38	0.16	108,000	62,000	20	47	1650 A.C.	1450 A.C.

*A.C. = air cooled; Anl. = annealed; O.Q. = oil quenched.

Table V

Steels With Higher Content of Chromium

Analysis, Per Cent							Physical Properties				Treatment* (Temp. in degs. Fahr.)
C	Mn	Si	Cr	W	Mo	N2	Ultimate Strength lbs. per sq. in.	Yield Point lbs. per sq. in.	Elongation in 2 in., Per Cent	Reduction of Area Per Cent	
0.25	0.53	0.42	5.87	0.80	....	....	125,000	100,000	18	45	N. 1750, D.1250
0.22	0.71	0.50	4.02	....	0.46	....	121,000	91,000	19	51	N. from 1650
0.12	0.50	0.45	13.56	....	....	....	97,000	72,000	20	42	1650 A.C.
0.30	0.63	0.78	18.56	....	....	....	104,000	73,000	13	13	
0.32	0.73	0.59	25.46	....	....	....	85,000	55,000	7	7	
0.42	0.76	0.45	24.30	....	....	0.22	106,000	71,000	12	12	As Cast
0.44	0.71	0.51	24.80	....	....	0.05	84,000	52,000	7	7	As Cast

"Properties of Low-Carbon Medium-Chromium Steels of the Air-Hardening Type," by E. C. Wright and P. F. Mumma, metallurgists, National Tube Co., American Institute of Mining and Metallurgical Engineers, February 1933.
*N. = normalized; D. = drawn; A.C. = air cooled.

Galvanizing Malleable Castings

Work is cleaned by tumbling, blasting and pickling before coating is applied

By GRAFTON M. THRASHER

CASTINGS, such as pipe fittings and light hardware, when removed from the annealing ovens usually are covered with a thin oxide scale, ranging in color from pale straw to deep blue or blue-black which is rather firmly adherent. This scale must be removed before pickling, either by sandblasting or tumbling with a plentiful supply of stars.

Some castings are so easily broken when first cast that they are given only a superficial cleaning before the annealing treatment. Sand thus left in the surface, especially in crotches or depressions, is hard to remove as the star points often are not sharp enough to pick out the extra hard scale which results from the admixture of sand.

Occasionally, through accidental breakage of an annealing pot, the excessive leakage of furnace gases and air into the pot will produce a heavy, brown, powdery scale on the castings. It is almost impossible to clean these so they may be galvanized properly as even after drastic sandblasting or excessive tumbling, a careful examination will show a little intercrystaline film of the brown oxide in the surface, which the usual pickling procedure will not clean. When this condition is observed it is best not to try to galvanize the castings, but to use them as *black*.

Examine Castings Carefully

In either the tumbling or sandblasting, methods the casting should be examined closely after the cleaning to see that crotches, depressions and monograms are free from sand or scale before pickling. If castings are not clean, the pickling operation is prolonged unnecessarily, and long pickling produces a spongy surface which dissolves rapidly in molten zinc to form dross, and a rough, drossy coating will result.

The practice, in steel work's galvanizing, of pickling in hot, dilute sulphuric acid with subsequent washing in cold water and then giving a flux dip of muriatic acid or zinc chloride is dispensed with as the malleable castings have, or should have, been freed of scale, and the extra handling involved is more costly than the small possible saving of acid cost. The sulphates produced by pickling malleable in hot, dilute sulphuric are also difficult to remove and cause complication by contaminating the flux coat, etc.

The usual procedure is to use a combination pickle and flux dip which may simply be diluted muriatic acid, or with the addition of hydrofluoric acid or zinc chloride. Zinc chloride sometimes is added to the bath by using it for stripping and repickling defective galvanized work; but this does not seem to be necessary.

Where the work is of such nature that there are no sand inclusions in the surface, the pickle may be made of approximately equal parts of muriatic acid and water (specific gravity 1.06 to 1.08). When the (*Please turn to page* 49)

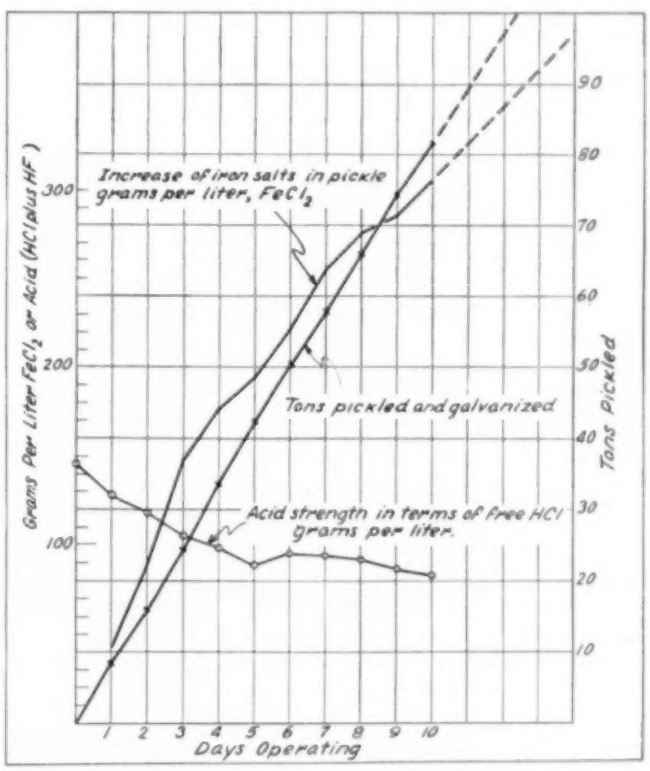


Fig. 1—Results of tests to determine acid strength, and increase in iron salts during period of ten days

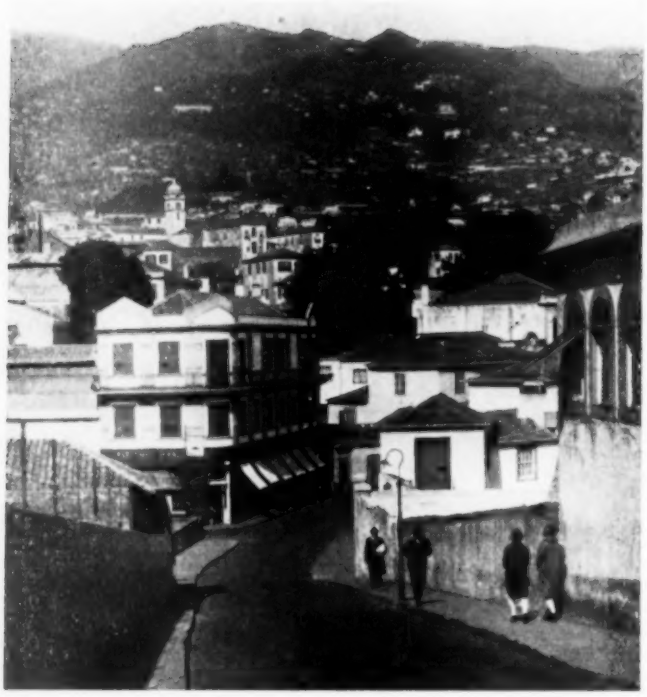


Fig. 1—View of Funchal, Madeira at the base of the mountain

Operates Foundry On the Island of Madeira

By J. H. QUICKE

MANY visitors to Madeira, referred to as *The Pearl of the Ocean* and *The Flower Garden of the Atlantic* by the propaganda artists of the touring companies will be surprised to learn that such mundane things as foundries and engineering works could exist in its holiday atmosphere. However, such is the case, and quite a lot of engineering work is turned out in that out of the way island with its quaint and antiquated methods.

For those who are not familiar with that part of the globe, the following facts may be interesting.

Madeira is the largest of a group of *four* islands situated in latitude 32 degrees 37 minutes to 32 degrees 52 minutes North and longitude 16 degrees 39 minutes to 17 degrees 17 minutes West. By steamer it is 7 to 8 days journey from New York, 9 to 10 days from Boston and 3½ days from Southampton, England. It is approximately 38 miles long, 15 miles wide and has an area of 240 square miles. The surface is mountainous and the highest point is over 6000 feet above sea level.

The climate is wonderful with sunny days practically all the year round. The average winter temperature is 61 degrees, and the average summer temperature 72 degrees Fahr. The temperature of the sea never falls below 64 degrees Fahr. Sea bathing is indulged in all the year round. Flowers always are in bloom. Except when the vines are pruned the place has an eternal summer appearance.

Madeira was discovered by the Portuguese in A.D. 1418, and has been in their possession ever since, with the exception of two periods from 1801 to 1802, and from 1807 to 1814 when it was garrisoned by British troops under The Treaty of Alliance.

The customs and manners of the people are quaint and at times an outsider might be pardoned for thinking he had slipped back hundreds of years in the world's history. There are no tramways, omnibuses or railways on the island. Until recently the only means of transport was a novel conveyance in the forms of a sledge drawn by a team of (*Please turn to page* 44)

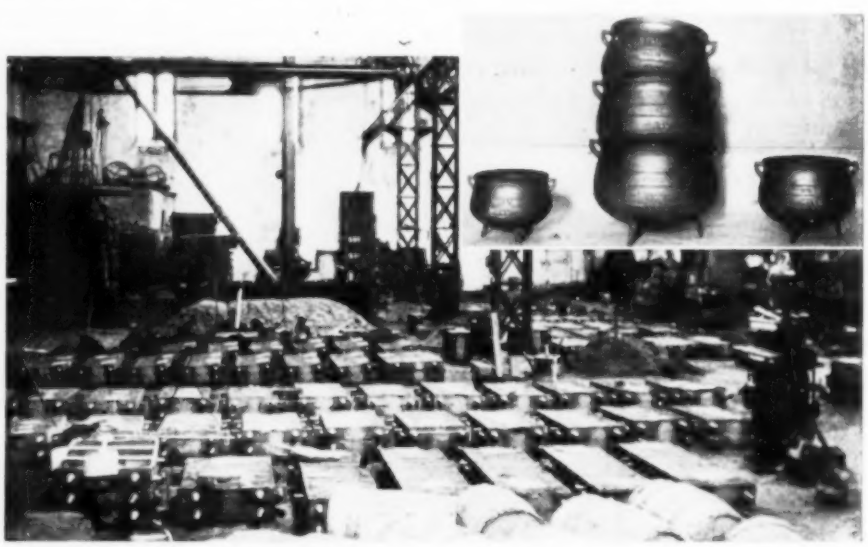


Fig. 2—A wide variety of castings is produced in this foundry by native employes. Inset upper right.—Type of cast iron pot made in many sizes

Needs Flexibility of Operation

Variables in nonferrous practice provide difficulties in setting definite work period

BY SAM TOUR

WHEN the National Industrial Recovery act was passed, no nation-wide trade association representing the nonferrous foundry industry was in existence. Under the auspices of the American Foundrymen's association, a technical society covering all of the various branches of the foundry industry of the country, a general meeting of nonferrous foundry executives was held in Chicago on June 23. Invitations to the general meeting were sent to every concern in the country known to be in the nonferrous foundry business.

It was the consensus of opinion at that meeting that the nonferrous foundry industry should be organized. To accomplish that purpose, an organization committee was selected and instructed to proceed immediately with the work. The program as laid out by that organization committee resulted in the formation of the Nonferrous Foundry Association for Industrial Recovery.

Collect Detailed Data

The task of collecting detailed production and employment statistics from all members of the association has not been completed. Therefore, it is necessary to estimate the figures for the entire membership based upon a knowledge of the individual members and based upon the replies received from approximately 50 per cent of them. In this fashion the following estimated figures have been arrived at, as to the present membership: Invested capital, $24,000,000.00; production capacity, 36,000,000 pounds per month; present rate of production, 12,000,000 pounds per month; present sales volume, $2,640,000.00 per month; present number of employes, 9300.

These statistics are estimated to represent over 60 per cent of the industry as defined in the code of fair competition as submitted. Attention is called to the fact that the definitions in the code as submitted exclude a number of branches of the Nonferrous foundry industry, namely: Die castings, railway car brass castings, castings produced for owned or affiliated companies, and castings produced under other codes submitted to the National Recovery administration. Other codes cover certain large divisions or branches of the industry as for example—valves and fittings, plumbers' brass goods, ornamental bronzes, bells, cast aluminum cooking utensils, etc., etc.

From approximately 400 replies received from the industry, we have, however, been able to calculate certain definite trends on production, wages and hours of employment.

Since the peak year in 1929 when the monthly production per man was approximately 2300 pounds of castings, production has fallen steadily until at the present time production per man per month is only 1255 pounds; a falling off in efficiency of production of approximately 43½ per cent. This is not an indication of a decrease in actual man efficiency as much as it is a definite indication of the action of the industry during these years of spreading the work and retaining men upon the payroll in spite of decreased business. The average production per man hour in the industry has fallen off from approximately 11¾ pounds per man hour in 1929 to 7.85 pounds per man hour in June 1933 or a decline of approximately 33.2 per cent.

The price of castings reached a peak in 1929 and 1930 of approximately 32.75 cents per pound and then suddenly dropped until the present average sales price per pound of nonferrous castings is only 21.75 cents per pound; a reduction of 33.6 per cent.

To determine how that decrease in sales price per pound affected the differential between average metal price and finished castings price, it was necessary to arrive at a composite representing average metal prices. The estimated consumption by the industry of these main metals is approximately 60 per cent of copper, 24 per cent of aluminum, 8 per cent of zinc, 4 per cent of tin and 4 per cent of lead. The differential between sales price per pound of castings and raw metal costs per pound was 17.25 cents per pound in (*Please turn to page* 52)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, N. K. B. Patch

Rust Appears on Castings After Both Shakeout and Cleaning

Can you throw any light on a peculiar rust problem in connection with our stove and range castings. Under former operating conditions when the molders dumped the castings in the intervals between pouring their iron we had but little trouble. Several years ago we adopted a system whereby a special shakeout gang shakes out all the castings at the end of the heat. The rusty areas vary in size from a pin point to several square inches. This rust is removed by sandblasting, but reappears in 24 hours in a denser and more aggravated form. Before the castings can be enameled they must be pickled, annealed and again sandblasted. We have had analyses of the sand and water and can find nothing in either to account for the formation of rust on the castings.

The fact that the sample castings submitted with this inquiry showed only isolated rust patches while the remainder of the surface is perfectly clean would seem effectually to nullify any ordinary theory which might be advanced to account for the phenomenon. If either the sand or water, or both is or are responsible one would expect to find the entire surface affected. The same is true if some extraordinary atmospheric condition prevails in the shop.

Under former operating conditions where the castings were shaken out almost immediately the rust did not appear. Under present conditions where the castings remain in the sand for periods up to an hour, the castings show patches of rust. Apparently the longer contact with the sand and steam is responsible for the rust, but opposed to this hypothesis is the possibility that composition of the sand and water is not the same as in former years. The second statement that the cleaned castings rust again after they have been sandblasted would seem to absolve the sand of all blame. However, a possibility remains that moisture in the sandblast stream is responsible for the second rusting. As in the first theory, the flaw in this supposition is that the rust only appears here and there instead of over practically the entire surface. It is a well known fact that castings rust more readily in sea coast than in inland foundries and more readily still the water or sand carry a salt content. Contradictory as the submitted evidence seems to be, we are inclined to the opinion that your present water supply is responsible for the development of rust on the castings, first in itself as a rust producing medium and second from its presence in the sandblast air line. As a preliminary step toward a possible long investigation we suggest you make a few sample castings in sand wet down with purified or distilled water. Then examine the air line for moisture and if necessary install suitable separator equipment.

Slush Castings Made in Bronze Molds Mounted on Swivel

Recently we have been asked to make some slush castings for ornamental lighting equipment. The castings are to be plated and must present a good surface appearance. The castings are similar to spindles and are about 9½ inches long, 1½ inches in diameter at the largest point and ⅝-inch in diameter at the smallest points. Other than calling for a hole ¾-inch in diameter at both ends, the requirements are not tightly designated. Can you give us any information on molds, suitable alloys, etc.?

Slush castings of the type you mention usually are made in bronze molds which are on a swivel so that they may be inverted to permit the liquid metal left after the shell has formed, to be poured out. With intricate castings having undercuts, etc., the mold will be in several pieces to permit removal of the casting. From your description, it appears that a simple two-piece mold with a joint line along the cavity will be satisfactory. Slush castings are gated at some point where the hole left after pouring out the liquid metal, will not affect its appearance or application.

With the casting you mention, it appears that the logical point to gate would be at one end

(the castings being poured in the vertical position) as the requirements call for a hole at that place. However, since the casting has its smallest diameter near the ends, there is a possibility that the metal will become frozen while the interior at the central portions still is forming a shell of the desired thickness. Naturally, it will be impossible to pour out the still liquid metal through the frozen end.

Consequently, you may have to do considerable experimental work in designing a mold that will operate satisfactorily. Possibly a mold that follows the contour of the casting to some degree so that the center is considerably thicker than those portions at the ends will cool the central portion sufficiently rapidly to form a shell of the desired thickness, and through slower cooling at the ends retard the shell formation so that the molten metal left could be poured out.

Obtaining walls of the desired thickness in slush castings is the result of practice by the operator, and it is surprising how accurately the thickness can be maintained within definite limits. Actually, on production, thickness determinations are not made often, but since the thickness of the shell determines the weight of the casting, the weight of the casting is used to check the thickness.

Generally, in slush casting work two metal pots are employed. One contains the metal which is being used to make the castings while the other is melting down a batch. Also the excess metal poured out from the castings is placed in the pot *on the make*. That allows an exact control of the temperature of the metal being poured. Close control of the metal temperature is necessary to obtain a uniform wall thickness as metal poured at a definite temperature and allowed to remain in the mold for a definite time will permit formation of a shell which varies little in thickness from casting to casting.

A considerable variety of alloys are available for making slush castings. Some are made of zinc containing 0.005 per cent aluminum which is claimed to increase the fluidity of the metal. In general lead-base alloys are employed; one for example containing 13 per cent antimony and the remainder lead.

Tin in Babbitt Bearings May Be Reduced

A customer using large quantities of babbitt which is made up to his analysis with approximately 85 per cent tin, would like to use a less expensive alloy if possible, providing it will withstand the wear and tear of electric motors operating at 750 to 1800 revolutions per minute. What alloy would you suggest?

We believe that an alloy containing 61 to 63 per cent tin, 9.5 to 10.5 per cent antimony, 24 to 26 per cent lead maximum, 2.5 to 3.5 per cent copper, 0.08 per cent iron maximum, 0.15 per cent arsenic maximum and zinc and aluminum, none, will be suitable for the bearing of electric motors since the bearing pressures are comparatively low and the speed high. That alloy is listed in the government specifications for antifriction alloys as suitable for the purpose outlined.

Casting Must Withstand Hot Hydrogen Sulphide Gas

We have an inquiry from one of our customers for some cast metal parts which will run up to about 1000 pounds in weight. The metal must withstand the action of hot hydrogen sulphide gas of about 30 to 40 per cent concentration. Our customer believes that cast iron with chrome in it will serve its purpose but he states that obviously nickel must be entirely absent. We do not know the temperature of the gases but if you desire this information, we can secure it. The hydrogen sulphide gas will contain considerable water vapor. Please advise what chrome content and iron mixture would be suitable for this service.

Aluminum and stainless steels resist hydrogen sulphide gas, wet or dry, hot or at room temperature. Regular cast irons usually are satisfactory on dry gas at ordinary temperatures. The addition of 0.6 per cent chromium very materially helps the resistance to wet and hot sulphide. Sufficient extra silicon must be added to prevent chilling and the formation of mottled iron. We regret that your inquiry does not give sufficient information on the size of sections and base mixture to specify the silicon content needed.

If a special iron can be used the new 35 per cent chrome cast irons will be found to have excellent resistance. Although white in fracture, they are not brittle as is the case with regu-

Massive bronze doors and highly decorative exterior electric lighting brackets at one of the doors of the new building of the Christian Science Publishing society in Boston. Illustration courtesy Copper & Brass Research association

lar white iron, and are about as machinable as high strength cast iron. Shrinkage is between cast iron and steel.

Small Cupolas Melt Iron for Castings

Can you tell us what is the smallest size cupola that can be used to make gray iron castings?

The smallest size cupola that we have heard of that was operated successfully was one with an internal diameter of 9 inches. Another small cupola was lined to 15 inches. Both cupolas mentioned are as far as we know still being used, and are located in the foundry departments of two colleges. As may be expected only small heats are melted in the cupolas. Mention is made of those tiny cupolas just to show what can be done along that line. You probably are more interested in cupolas for commercial operation from which a reasonable tonnage may be secured. The smallest size manufactured so far as we know is one 18 inches in internal diameter, sometimes called a cupolet. Such a cupola will melt about ½-ton per hour. A cupola 23 inches in diameter will melt around 1 ton per hour while a 27-inch cupola will melt 2 tons per hour. From 3 to 5 tons of metal per hour are melted in a cupola lined to 32 inches.

Roasted Clay Is Used in Steel Foundries

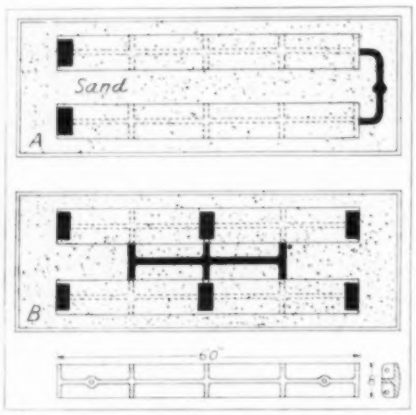
How does the clay or *chamotte* used for facing in European steel foundries compare with the clay employed in American steel foundries? Has this roasted clay or chamotte been tried out in any foundries in the United States?

Chamotte is a highly aluminous clay of the following approximate composition: Alumina 31.75-42.70 per cent; silica 55.00-64.00 per cent; ferric oxide 1.00-2.50 per cent; lime trace to 0.50 per cent; magnesia 0.17-1.00 per cent; titanic oxide trace to 1.80 per cent; soda trace to 0.25 per cent; potash trace to 0.45 per cent. The fusion point, cones Seger, usually is about 34 to 35, that is from 1750 to 1770 degrees Cent. or 3180 to 3220 degrees Fahr.

In European steel foundry practice the clay in 9-inch cubes is roasted at a temperature over 1500 degrees Cent. (2732 Fahr.). After it has cooled the clay is broken down and ground to the required fineness. This calcined clay is mixed with a raw clay binder in the proportion of 85 per cent by weight calcined clay and 15 per cent raw clay. Sufficient water is added to render the material workable. Permeability of this material in the green state is 2000 or over. A dry permeability test is unobtainable since the mercury runs through the test piece. This extraordinary permeability accounts to a great extent for the success of the material as a steel foundry facing material. A sample lot of the material has been undergoing experimental tests at the naval research laboratory, Anacostia, D. C.

Gating System on Steel Castings Optional

We shall appreciate your opinion and comments on which is the better method for gating the steel casting shown in the accompanying sketch. The casting is not machined, therefore you will take into consideration the extra cost of metal and cleaning involved in one method.



Satisfactory castings will be produced by either method shown

The casting is poured in a green sand mold and the flask is elevated at one end. In service the castings are bedded in concrete to form a steel armor for river locks.

Either system shown in the sketch will produce satisfactory castings for the purpose intended, since the castings merely constitute a reinforcing band subject neither to tensile, torsion or direct impact shock. At least any impact imposed will be distributed over a comparatively wide area and will be absorbed by the concrete backing. Your problem depends on the character and rigidity of the inspection and the interpretation the inspector places on the letter of the specifications.

The second method shown, gates in the center and three feeders, assuming of course that melting, pouring and molding practices are perfect, will insure the production of a solid, homogenous casting competent to pass any and all tests. Under the same conditions the first method, gates at one end and one feeder, will produce a casting free of any major defect and reasonably suitable for the intended purpose. However, a rigid inspection which insists on breaking one of the castings probably will disclose incipient shrinkage cracks at the junction of the longitudinal and one or more of the transverse ribs. Under a reasonable inspection the presence of a microscopic crack or draw should not constitute a defect, since the same condition, in infinitely accentuated proportion, an actual break in continuity, is accepted at the junction of each pair of castings. However, as previously mentioned, the inspector's attitude will decide that point.

Clean Castings Aid Finishing Process

We are manufacturing memorial tablets in 88-10-2 and 85-5-5-5 alloys. The tablets must be made of a mixture that will not turn green when used outside, and it must oxidize readily and uniformly when immersed in solution. Our difficulty is with oxidizing as we cannot obtain a uniform yellowish-brown color. Will some other metal mixture be better?

To obtain satisfactory oxidized finishes on brasses and bronzes requires considerable experience. The castings must be clean in the first place so that a uniform finish may be obtained. A bronze finish is said to be produced on the 85-5-5-5 alloy through the use of two solutions, and it will require some experimentation to determine the proper procedure. The first solution is comprised of 2 ounces of golden sulphuret of artimony, 8 ounces of sodium hydroxide (caustic soda), and 1 gallon of water. The solution is heated to around 150 degrees Fahr., and the castings immersed in it for a few minutes. Then the castings are dipped, without rinsing, in a bath composed of 8 ounces of sulphuric acid in 1 gallon of water for a moment. After the acid dip they are allowed to dry. If the color is not dark enough, the process is repeated.

For coloring bronze in various tones ranging from brown to black, sodium sulphide solutions are used. The depth of color depends upon the amount of sulphide used. For light brown try ¾-ounce of sodium sulphide to 1 gallon of water. The solution should be heated to 90 to 100 degrees Fahr. Lacquering after the proper finish is obtained is necessary to preserve it. It seems to be generally recognized that the 85-5-5-5 alloy is harder to color than others, and some founders recommend the use of an alloy containing 88 per cent copper, 4 per cent tin, 4 per cent zinc, and 4 per cent lead. The difference as you can see lies in the increased copper content.

Viewing Foundry Developments

At Short Range

ASBESTOS covered wire commonly used in electric heating apparatus is being used to provide oil holes in castings. The asbestos covered wire is bent to any shape desired and placed in the mold. The ends of the wire may be supported by core prints and chaplets may be employed wherever necessary to support the wire on the inside of the casting. After the casting has been poured and shaken from the mold, the wire can be pulled out easily and the asbestos removed with compressed air.

• • •

Innoculated iron is a term descriptive of cast irons which ordinarily will give a white structure on casting, but through ladle additions acting as graphitizers, a gray structure is produced. The irons are said to have a tensile strength around 49,000 pounds per square inch, and with alloy additions up to 67,000 pounds per square inch.

• • •

A new metallic zinc paint which has been developed is claimed to resist rust and corrosion due to atmospheric exposure for a period twice as long as for red lead paint.

• • •

IT IS said that the difference in cost in favor of the cast alloy iron crankshaft as compared to the forged steel type is about $1. That appears to be a small differential, but when a production of 2,000,000 cars which is the estimate for 1933, is considered, it is a worthwhile innovation.

• • •

Centrifugal casting of high-chromium steels makes possible the production of large tubes from compositions which at present cannot be fabricated into seamless tubing. Tubes larger than those obtainable from high-chromium steels capable of being pierced have been made in that manner. Recently several tubes were cast successfully from a steel containing approximately 25 chromium, 12 nickel and 0.30 per cent carbon. These tubes had a diameter of 13 inches, a wall thickness of ⅝ inch and a length of 12 feet. They were installed in a chemical process operating at 1830 degrees Fahr.

• • •

DUE to the inequalities in temperature from top to bottom of automotive cylinders of the air-cooled type during operation it has not been practicable to cast them en-bloc like the water-cooled type. However, one producer found that by casting them with a narrow connection between the tops of the cylinders which later was severed after machining the tops and bores, good results were obtained. The bottoms, of course, are joined to form the upper half of the crankcase as in the case of the water-cooled cylinders.

• • •

Foundry practice for the comparatively new beryllium-copper alloy castings closely resembles that for phosphor bronze. The master alloy is used as a raw material for introducing beryllium into the alloy. The aim is to secure a range of 1.50 to 2.50 per cent beryllium. The 2.50 beryllium-copper alloy is regarded as standard for castings. In heat treatment the alloys belong to the precipitation-hardening class. After a solid solution treatment, hardening can be attained by heating 2 to 3 hours at 525 to 575 degrees Fahr., and air cooling. High tensile strengths result, with hardness values up to 500 brinell. Alloys of beryllium and copper show high wear resisting and anticorrosive properties.

• • •

In an endeavor to secure malleable iron castings with high strength, moderate ductility and considerable resistance to nonlubricated abrasion, chromium additions ranging from 0.25 to 1.15 per cent have been tried with silicon varying from 1.02 to 2.02 per cent. Maximum tensile strength was secured with 0.84 per cent chromium and 1.57 per cent silicon. Elongations decreased as the chromium was increased. Hardness also increased. Elastic limits increased up to 62,500 pounds per square inch.

• • •

The nitriding process is being applied economically to gray iron castings requiring extremely high wear resistance. The *Symposium on Cast Iron* states that low total carbon, chromium, aluminum irons originally were developed for nitriding purposes. It is claimed that chromium-vanadium irons also respond to nitriding treatment satisfactorily. Nickel also is used in nitriding irons to increase strength and toughness.

• • •

METHOD to treat molten iron and steel, particularly iron, so that it is refined and deoxidized recently has been patented. It consists essentially of passing the molten metal through a column of granular, carbonaceous material which is heated through an electric current. The column is enclosed in an air-tight refractory chamber, except for the top layer, and it is claimed that only a slight oxidation occurs in that layer. The carbonaceous material may be graphite or coke, and with the latter the sulphur pick-up is extremely low.

Index Is Ready

AN INDEX of all articles published in THE FOUNDRY during 1933 and giving a complete reference and cross reference to the material which has appeared in each of the issues, has been prepared for distribution. Readers who bind or preserve the back issues of this publication will find the index of great value in referring to articles which have been published. A copy of the index will be mailed free of charge to any subscriber who requests it from THE FOUNDRY, Circulation Department, Penton Building, Cleveland.

Men of Industry

Whose Activities Are Making Foundry History

JOB GOOSTRAY was made a life member of the American Foundrymen's association by vote of the board of directors at a meeting held in Cleveland Dec. 7. Mr. Goostray was born Nov. 28, 1850 near Manchester, Eng. He was taken out of school at the age of 12 and placed at work in a foundry where he remained for 8 years until he emigrated to America. In 1870, at the age of 20, Mr. Goostray came to America and obtained his first employment on this side with the locomotive works, Manchester, N. H. Later he worked for varying periods in other foundries in Manchester and Concord. He joined the South Boston Iron works, now Hunt-Spiller Mfg. Co., Boston, in 1880 at a time when the company was engaged in the manufacture of large pumping engine castings for the Hecla Mining Co., and the Boston water works. In 1892 he was appointed foundry foreman and retained this position until a few years ago when he was relieved of active supervision and retained in a consulting capacity.

Job Goostray

F. EDWARD O'NEIL, has been elected president, Fulton Iron Works Co., St. Louis. Mr. O'Neil has been associated with that company since 1905, starting as an apprentice in the machine shop. From 1917 to 1928 he was vice president in charge of the New York office and then returned to St. Louis.

HOWARD COONLEY, president, Walworth Co., Boston, has been reelected president of the American Standards association for 1934.

W. D. MOORE, president, American Cast Iron Pipe Co., Birmingham, Ala., has been elected first vice president of the Birmingham chamber of commerce.

FRANK G. BRINIG, for 8 years assistant sales manager, Erie City Iron Works, Erie, Pa., and for the past 6 months works manager, has been named general manager of the company.

JOHN C. TAYLOR, vice president in charge of sales, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., has been elected a director of Taylor-Wharton and associated companies.

DAVID R. WILSON, president, Wilson Foundry & Machine Co., Pontiac, Mich., recently was appointed receiver for the Willys-Overland Co., Toledo, succeeding L. A. Miller, president and former receiver.

ADDIS E. MCKINSTRY has been elected president, International Harvester Co., Chicago, succeeding the late Alexander Legge. Mr. McKinstry formerly was first vice president of the company. In 1929 he served as president of the National Association of Farm Equipment Manufacturers.

FRANK M. ROBBINS, formerly vice president and assistant general manager, Ross-Meehan Foundries, Chattanooga, Tenn., has been elected president of the company succeeding the late A. F. Meehan. A graduate of Doane academy, he received his bachelor of science degree at Denison university, Granville, O., and took a 2-year post graduate course in mining and metallurgy at the Colorado School of Mines. For a number of years he was a member of the engineering corps of the Pennsylvania and the Baltimore & Ohio railroads. In 1911 he became connected with the Marion Malleable Iron Works of the Chicago Railway Equipment Co., Marion, Ind., as an engineer, and remained with that company for 7 years, in various capacities including that of assistant superintendent, and finally secretary and sales manager. In 1913 he was appointed vice president and general manager of the Positive Rail Anchor Co., another subsidiary of the Chicago Railway Equipment Co.

Frank M. Robbins

In 1918 he became assistant general manager of Ross-Meehan Foundries and later was made vice president of that company. He also was vice president of the Meehanite Metal Corp.

Other officers elected are as follows: A. LEE READ, vice-president in charge of research; HARRY R. DAVIES, vice president in charge of sales; and HENRY BOND, secretary and treasurer.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Beyond Control

TO THE EDITORS:

Your editorial "No Time for Shylocks" has been carefully noted, and I wonder whether you should not point out to your readers that the changes in conditions resulting from NIRA provide all the basis necessary for revision of contracts.

Substantially every formal contract has in its printed terms some stipulation regarding fires, strikes, accidents, causes beyond control, etc. Certainly acts of the government, such as the NIRA with all its primary and secondary consequences in the way of advancing costs, come within the scope of such a provision.

Would it not, therefore, be entirely in order for all foundries to make that a basis for insisting upon a revision of contracts?

PRESIDENT

Water on Risers

TO THE EDITORS:

I am indebted to Mr. Deschamps, whose letter is published in your December issue, for discussing the use of water on hot risers of steel castings, said to be common practice in Europe. This procedure was mentioned in Captain Shane's report of his inspection of European steel foundries, referred to in several of your recent issues.

Captain Shane did not explain, in his article published in the Journal of the American Society of Naval Engineers, the object sought by such water immersion, as elucidated by Mr. Deschamps. My comments were influenced by such information as had been made available to me.

While the sudden chilling of the hot sand forming the riser walls undoubtedly accelerates the disintegration of the sand mass, occasionally lowering its resistance to certain contraction stresses that may affect the casting, I suggest that if all the results could be ascertained, water chilling in the long run might be found to do more harm than good; considering the need for a liquid reservoir to supply contraction voids until these are completely compensated for within the casting proper, and in view of the impossibility of confining the chilling process to the sand without some effect on the riser and/or on the casting beneath it.

R. A. BULL

541 Diversey Parkway
Chicago.

Fill 'Em Up Again

TO THE EDITORS:

For several years you presented an interesting series of short articles under the heading "Find Where Castings Can Be Sold" illustrated by a wide variety of domestic and industrial machines made up in whole or in part of castings. The writer has developed a compact and original design auto compressor and pump for beer dispensing purposes. Many engineers have pronounced this the neatest and most complete unit on the market and of course I think so myself. It is practically all castings, motor, pump, base, tank and regulator. In the complete absence of vibration no necessity exists for bolting the pump to a foundation. The unit rests on four soft rubber pads. Instead of hiding it from view this piece of equipment may be displayed openly where it will serve as an advertisement of the up to the minute character of the establishment.

JAMES A. MURPHY

Jas. A. Murphy & Co.
Hamilton, O.

A Better Rate

TO THE EDITORS:

On page 32 of the November issue of THE FOUNDRY under "Reader's Comment" I was interested in the statement of actuarial experience of manual code 3086 covering malleable foundries.

Several months ago I made the suggestion to Thos. P. Kearns, superintendent of the Ohio department of safety and hygiene, that a possible method of getting the many Ohio plants not now interested in safety work to take up this work, would be to organize groups of plants operating and paying under the same code number, the plants themselves to then undertake the development of proper safety work in all plants not already so organized.

For instance, this company is vitally interested in the performance of all plants using manual No. 3086. The combined experience of all such companies determines the base rate under which we all pay. True we or any other individual company may enjoy a credit rating, in proportion as our experience is better than the average but utmost economy can only be effected when group performance justifies a minimum base rate.

I suggested a questionnaire of some form be sent to the management of all companies under any given manual. From the information secured those plants having successful safety programs and enjoying credit ratings be asked to extend to those not so fortunate an interested helping hand in securing better safety performance, self interest in securing a better base rate for themselves would I think be a sufficient incentive to warrant them doing this. The state could be divided into sections and no one would have to help at any far distant places.

Mr. Kearns agreed to the possibilities of the plan but said that his department, with present reduced personnel could not organize such a program.

I am personally convinced that by narrowing the field to groups of plants who are financially interested in the performance of the other fellow that we can make a real advance in safe operation in the foundry industry.

A. D. LYNCH
Director of Personnel

Ohio Brass Co.,
Mansfield, O.

Similar Problem

TO THE EDITORS:

In your November, 1933 issue, under heading "Questions and Answers," on page 26 is an article headed "Pulley Rim Shows Dirt After Machining." This problem is very similar to the one we had with our small gear blanks. On cutting the teeth shrinks would almost invariably appear. We were running an iron around 3.30 per cent total carbon and 1.75 per cent silicon. The largest section of these blanks was 2½ x 4 inches being on the rim and the smallest section was about 1 inch at the spokes or web as the case might be.

Our trouble was solved by lowering the total carbon to around 3.10-3.20 per cent raising the silicon to 2.00-2.10 per cent depending on section and adding 1.00-1.50 per cent nickel shot. We have not been troubled by shrinkage problems in these castings since then and the resulting metal due to finer and better distributed graphite has been stronger and "finer grained."

On our larger gears which run up to 7 x 14 inches at the face, with 3½ x 6 inches oval or elliptical arms and varying sizes and shapes of hub, we have made satisfactory close grain-

ed gear blanks by two methods and both are quite acceptable. One method is to reduce total carbon to 2.70-3.00 per cent and silicon from 1.75-2.00 per cent depending on section and using 1.50 per cent nickel and 0.50 per cent chromium. The other is by taking the base iron for the small gears, namely 3.10-3.20 per cent total carbon and 2.00-2.10 per cent silicon (this being standard gray iron for the majority of our floor work), and adding varying amounts of molybdenum and chromium up to 0.60 per cent molybdenum, keeping the chromium about ½ as high in content as the molybdenum.

The first method is best adaptable when the majority of the work on the floor is of heavy and even enough section to take the lower carbon iron. The latter best for cases where the larger percentage of the work is of higher carbon content.

We dislike to run more than two kinds of iron from our cupola and have found that proper alloy additions will pay us in our machine shop many times over in the cost of alloy to the foundry.

HENRY C. GRIGGS

Waterbury Farrel Foundry & Machine Co.,
Waterbury, Conn.

Cupola Lining

TO THE EDITORS:

The increasing use of steel, in the manufacture of stronger iron castings, has put cupola linings to a severe test. Some heats made with a new lining have eaten away as much as 6 inches of brick in a single heat, necessitating patching after each heat, and making a new lining necessary about every fourth heat.

Mica-schist, a natural rock, has long been known as a refractory material, but was used little owing to its lammelar structure, which would crack off into thin plates, when used for patching. If, however, a complete lining of mica-schist be placed in the melting zone of the cupola in such a way that it would be impossible to flake off, that is, instead of exposing the face of the material, we expose the end section, we have a lining that is more resistant to the heat and to all other action in the cupola.

In laying up this stone the pieces are irregular in shape and therefore do not fit as snugly as firebrick does. However a grouting of mica fines and from ½ to 1/3 fireclay makes a good mortar for laying up this material. The space between the stone and the lining or shell of the cupola can be filled with fine mica, as there is practically no shrinkage and a tight wall is obtained.

For smoothing the wall a thicker mixture is buttered on the inner lining making a smooth surface and protecting the wall.

This material takes a fine glaze and the cupola drops clean, and the lining lasts longer, offsetting a slightly higher labor charge on installing.

GEO. H. ETTELE JR.,
Chemist

Kutztown Foundry & Machine Co.
Kutztown, Pa.

For Years a Reader

TO THE EDITORS:

In the November issue of THE FOUNDRY on Page 26, there appears a question about a pulley, that has caused the maker a great deal of trouble. At the works here, where I am the manager, we have lately had an order on almost identical pulleys and met the same troubles as described.

Having tried the same remedies as your man without success, we solved the problem by adding on the pattern 4 inches to the height of the ring, poured with the web down and gated from the outside into this. We made many of them this way, and all came out perfectly clean. Of course we had to cut the surplus ring off after machining in the lathe.

I take the opportunity to relate, that I have been a subscriber of THE FOUNDRY ever since my apprentice years 1896-1900 in your great country and read every copy with great interest.

Wishing you a Merry Christmas and a bright and prosperous New Year, I remain a thankful reader of your splendid paper.

ERNST ADAMSON
Works Manager

A. B. Separator
Tullinge, Sweden.

Societies Publish Symposium on Cast Iron

The American Foundrymen's association and the American Society for Testing Materials have published jointly in book form the *Symposium on Cast Iron*, which was presented at a joint meeting of the two societies held in Chicago, June 26, 1933. The material in this symposium represents the latest authorative data on the properties of gray iron castings, and represents the combined efforts of a group of outstanding foundry metallurgists. The symposium will be of exceptional value to the engineering profession as well as to the foundry industry.

The text treats with a brief historical sketch and then takes up the various steps in the manufacture of gray iron castings. This is followed by a discussion on the metallurgy of gray cast iron, including the influence of alloys, the properties of gray cast iron, classifications and specifications, heat treatment of gray cast irons, white and chilled irons, welding, and foundry factors of importance in the production of iron castings.

The symposium may be purchased, for $1.00, with special prices for quantity purchases.

Submits Cost Schedule to Members

Board of directors of the Malleable Founders' society, administrating agency of the code of the malleable iron industry, met in Cleveland Jan. 4. The manner of handling interpretations of the code and complaints pertaining to sections other than those affecting labor was established. A committee of five board members will act as a committee on interpretations and will rule on questions submitted to the secretary by members of the industry.

The investigation of complaints in each of the three sections of the country will be handled by a sectional code authority. A system for adjusting complaints pertaining to labor is to be established.

The Malleable Founders' society has submitted a cost schedule which is being analyzed by members of the industry and by cost experts of various foundries. A provision of the code calls for a uniform standard method of cost finding and further empowers the board of directors to determine periodically fair and reasonable costs of production in the industry for different types of malleable castings. Selling castings below the fair and reasonable cost of production will be a violation.

The members of the board of the Malleable Founders' society charged with the administration of the code follows: R. R. Fauntleroy, president, Malleable Founders' society, Moline Malleable Iron Co., St. Charles, Ill.

Western division, E. E. Griest, Chicago Railway Equipment Co., Chicago; L. M. Eyke, Terre Haute Malleable & Mfg. Co., Terre Haute, Ind., and J. G. Malnoski, Muncie Malleable Foundry Co., Muncie, Ind.

Central district, John C. Haswell, Dayton Malleable Iron Co., Dayton, O.; A. F. Jackson, Michigan Malleable Iron Co., Detroit; C. C. Gibbs, National Malleable & Steel Castings Co., Cleveland; and R. N. Cole, Canton Malleable Iron Works, Canton, O.

Eastern division, C. L. Berger, Eastern Malleable Iron Co., Naugatuck, Conn.; H. L. Steeves, Rhode Island Malleable Iron Works, Hillsgrove, R. I.; T. F. Hammer, Malleable Iron Fittings Co., Branford, Conn.; P. R. VanDuyne, Meeker Foundry Co., Newark, N. J. Robert E. Belt, Cleveland, is secretary of the society.

MOLY

increases steel's resistance to fatigue

IT WAS probably *fatigue* that finally and all at once brought the Deacon's "one-hoss shay" down to a crumbling end. It is *fatigue* — the breakdown of the crystal structure due to mechanical vibration or other alternating stresses — that so often causes an apparently sound driving axle, shaft or gear suddenly to give way.

A surprisingly small percentage of Molybdenum added to steel (even when other hardening or toughening alloys are used) increases its resistance to fatigue because, among other things, Molybdenum permits higher drawing temperatures after quenching—therefore imparting greater stability against molecular rearrangement.

Whether it be resistance to fatigue or any of the other major qualities sought in steel or alloy-steels, we know of none that cannot be improved through the addition of Molybdenum. The history of this remarkable product is a series of extraordinary successes — proof of which is being found almost daily in a wide range of foundry, machine-shop and service applications.

There is scarcely a steel problem that Molybdenum cannot help solve. Have you one? The modern Climax laboratories in Detroit, including free engineering and experimental service, are at your disposal. Write for complete information and interesting new booklet entitled "Molybdenum in Cast Iron." Climax Molybdenum Company, 295 Madison Avenue, New York City.

CLIMAX Mo-lyb-den-um

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

THEORETICALLY the best way to fill a mold with steel is to pour the metal straight down the sinkhead and fill the top slowly. The heavier sections should be above the lighter, that the top may freeze last and feed the bottom. The bottom sections of some castings should be poured in chills and there should be extra metal above the casting proper to form a sinkhead that will feed the upper portion as it shrinks.

The foregoing pouring method includes all the available means for obtaining sound ingots. However, the method—at least in its entirety—is not applicable to sand, particularly green sand molds. A stream of metal falling into the mold would cut the sand and ruin the casting. Intervening cores would be destroyed. Hence in the majority of cases the metal must be poured down a sprue or runner exterior to the casting itself and into the mold cavity through a gate or gates at or near the bottom. The bottom of the sprue is dished and the surface is nailed to form a basin from which the metal enters the mold quietly and without cutting the sand, or spattering in such a way as to lead to surface imperfections in the casting.

In bottom poured molds the metal which finally forms the top of the casting is the first which enters the mold and therefore is the coldest. This is in direct violation of a theoretical principle, but usually the foundryman has no practical alternative. He can stop pouring through the gate when the metal reaches the bottom of the sinkheads and fill these from the top. This practice is common and also theoretically correct, but in some cases is not sufficient to insure a solid casting.

Nullify Feeding Effects

The upper part of a tall casting may cool to such an extent before that of the bottom portion, poured last, as to impair or nullify the feeding effects of the sinkheads. In an extreme instance the top metal may be so cold when pouring stops that it freezes completely and forms only its own small pipe. The sinkhead will feed this, but the later freezing lower portions will form their own contradiction cavities, completely bridged off from the sinkhead by the frozen upper portions of the tall casting.

From Many Pens

INTERMITTENTLY over a period of many years THE FOUNDRY has presented articles on steel foundry practice including the important features of gates and risers. Since comparatively few readers have access to this material, and since in many instances the reference to gates and risers is merely incidental to the main theme, the present writer has deemed it advisable to draw freely on these scattered founts of knowledge, to arrange the items in orderly sequence and to interpolate comment at discretion. Acknowledgement hereby is made to John Howe Hall for the material in the present article, based on a paper "Defects in Steel Castings and the Remedies for Them" presented before the 1914 convention of the American Foundrymens association.

In some instances it is possible to arrange a series of gates at several levels. When the mold and sprue are filled up to the level of the second gate from the bottom, the metal will enter the mold through this gate and run in over that already in the mold. When the steel reaches the level of gate three, the process will be repeated. This method presents the advantage of top pouring, at least in part, by pouring in a series of sections. Each section, to a certain extent serves as a sinkhead for the part immediately below. The sinkhead proper feds the last or top section of the casting. This is the first advantage of the use of gates at several levels. The second advantage will be referred to later in discussing the sizes of gates, runners and sprues.

Certain disadvantages may prevent the use of this method in some cases. Any loose sand from any source which ordinarily might float upon the steel and be carried upward to the sinkhead where it would do no harm, may be trapped in the casting when the metal begins to flow in through the upper gates. The second disadvantage lies in the danger of filling the sprue too quickly, so that the metal will flow in through the second gate and cut the mold wall as it flows down, before the metal in the casting has reached the second gate level. However, these disadvantages in many cases are neither insurmountable nor prohibitive in the application of the method.

The present discussion is limited to a consideration of gating problems in connection with large molds where a considerable volume of molten steel flows through the gates and where many of the precautionary and other features differ radically from those in vogue on smaller molds, particularly those made in green sand.

Results in Piping

Considering the subject of chills from the standpoint of their first and main function, that of decreasing the size of the shrinkage cavities, Professor Howe in *Piping and Segregation of Steel Ingots, Transactions* of the American Institute of Mining Engineers, 1907, shows that if the bottom third of a casting, for instance, is poured in heavy chills, that third of the casting is given the maximum tendency to pipe. Piping is the more pronounced the more the rate of cooling of the outer layers outstrips that of the inner layers during the first period of cooling. Heavy chills favor this condition.

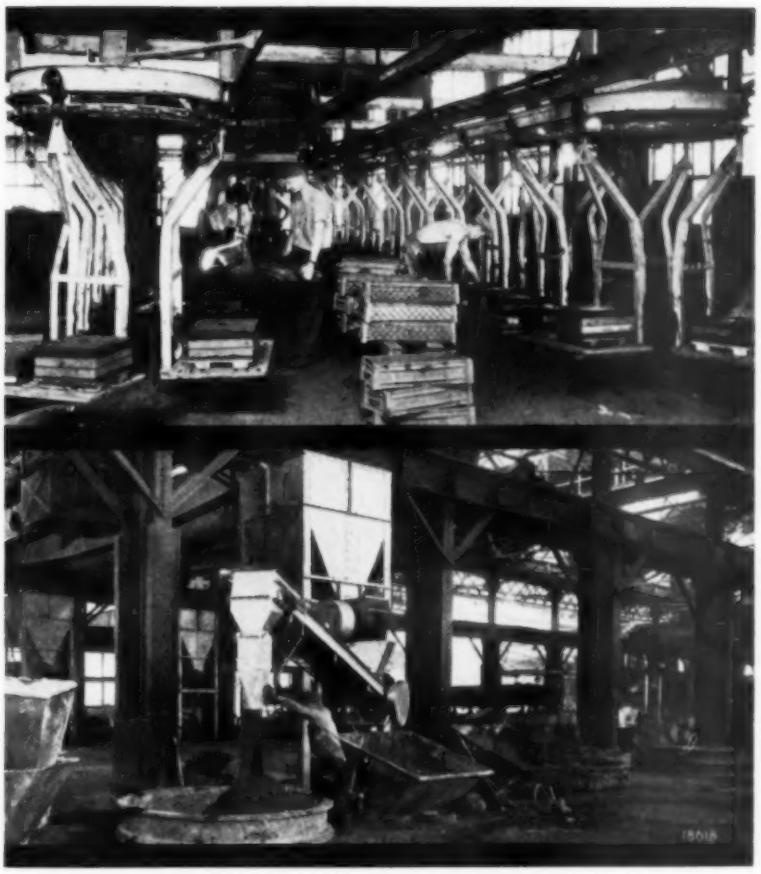
Thus the bottom third of the casting is caused to pipe deeply and—since the cooling as a whole will be rapid—to pipe early. If this early and deep piping can be started while metal still is flowing in through the gate, the fresh metal partly will fill the cavity while pouring still is in progress. Thus part at least of the object sought, the feeding of the casting, takes place during the pouring operation.

In certain cases where the vertical height of the casting is considerably less than that of the sprue and where no separate sinkhead is used, the sprue itself may be considered as the sinkhead since it is the only source of supply of molten metal. Under these conditions the action of properly placed chills may cause the feeding of the casting by the metal being run in to proceed so far that the metal remaining in the sprue will complete

(*Continued on page* 32)

Jeffrey Pendant Type Mold Conv. at Pouring Zone.

One of the many Jeffrey Flask Fillers (below), of the Overhead Bin type with revolving boom, serving a large Steel Foundry.



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Today, efficient foundry operation is more imperative than ever. Often, the investment of a very few dollars in equipment properly designed and applied brings big returns.

Jeffrey Engineers will—without obligation—help you select the right type of mechanical equipment from the complete Jeffrey line—and help you put your foundry on a more efficient and cost-saving basis.

Write for complete information.

Some 1933 Installation's

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NRA MEMBER U.S. WE DO OUR PART

(*Continued from page* 30)

the work after pouring ceases and result in a perfectly sound casting.

Of course the gates and chills must be arranged so that the later poured metal may flow in over that already in the mold. Hence that part of the mold in the neighborhood of the gate must not be chilled. Also it is essential that the first metal shall be poured rapidly and the final pouring completed slowly.

In some cases the sprue will feed a casting of this kind even without the assistance of chills. In others the chills are necessary to insure the production of a sound casting. In every case the casting must be low in comparison to the height of the sprue and no considerable portion must project above the level of the gate.

Theoretically to produce a sound casting by the metal in the sprue alone, a gate from top to bottom

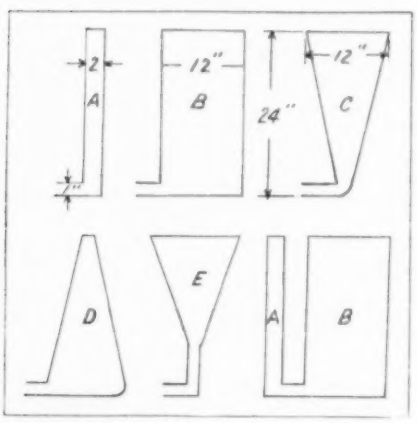

Fig. 220—Height of the sprue is the only factor which affects the pressure of the metal in the gate

should be provided on one side of the casting, so that feeding at all levels of the casting is effected by the metal running in from above. Actually, of course, the gate need not be quite the full height of the casting.

Even where a sinkhead is used in addition to the chills, so that dependence is not placed upon the sprue alone to feed the casting after pouring ceases, the effect of the chills is valuable since it affects the feeding of the lower portions of the casting by the metal flowing in through the gate. To take full advantage of the sinkhead the metal should be poured separately and from the top. Otherwise the head will be filled with the metal which first entered the mold and which has been cooled by the chills. As a result the head will show a tendency to cool before the casting it is designed to feed.

A high casting poured through a single gate at the bottom may freeze at or near the top to such an extent as to form a bridge between the bottom of the sinkhead and the adjoining part of the casting, with the result that the casting will be unsound. Gates at several levels may serve as a preventative measure. The same end may be attained in certain cases by the use of chills on the lower parts of the casting which hasten the cooling of these portions and cause them to freeze ahead of the upper parts.

Manifestly it may be advisable in many cases to use both methods since their effects are cumulative. Where all the metal is poured through a gate at the bottom the effectiveness of the chills inevitably will be reduced by the chilling of the metal that first enters the mold and ultimately forms the top of the casting. This metal has to flow over the chills to a certain extent and consequently is not as hot as it should be when it reaches the final position at the top. Where the metal enters at several levels successively, the bottom of the casting is filled by the first metal entering the mold. Hot metal is run in on top of it through the upper gates. In addition, the freezing of the lower portion is hastened by the chills. Thus the full benefit of both the chills and the pouring in layers is secured so that their effects are cumulative.

Laws of Fluid Pressure

Laws of fluid pressure are of great importance and constantly must be kept in mind in deciding upon the relative sizes of gates, sprues and runners. Misconception of these laws frequently leads to the adoption of faulty feeding and pouring methods. A great amount of metal is wasted as scrap sprues and sinkheads without serving in any useful way to make sound castings.

In any body of liquid, be it water or fluid steel, the pressure exerted per square inch at any given point is dependent upon the depth of that point below the surface. The pressure at that point is equal in all directions. Thus the several sprues shown in Fig. 220 all exert the same pressure on the 1-inch gate. There is no more tendency to "force the metal into the mold" in the large sprues *b*, *c* and *e* than in that of the small sprue *a*. That the pressure in each case is the same easily may be demonstrated by joining *a* and *b* as shown at the lower right in Fig. 220, and filling both with liquid. The surface level of the liquid will be the same in both. Obviously if there were a greater tendency in *b* to "force the metal through the gate," the metal would rise in *a*.

A second important point in this connection is that when the metal, for example, is at a higher level in *a* than in *b*, it tends to flow into *b*. The effective pressure on the metal in the gate is proportional to the difference between the level in *a* and that in *b*. As *b* fills up, this effective pressure decreases and becomes zero when the metal is at the same level in both members. If *b* is fuller than *a* the same condition exists, but the direction of the flow will be reversed. The fact that *b* is of greater cross section than *a* does not make the effective pressure at the gate any greater when the level of the metal in *b*, for example, is 6 inches above that of the metal in *a*, than it is when the level in *a* is 6 inches higher than that in *b*.

The foregoing leads to a consideration of the proper relative proportions of the size of gates and sprues. The sprue obviously should be large enough to carry the metal to the gate as fast as it is needed. Therefore it must be large enough to carry away the proper sized stream of metal as fast as it is poured from the ladle. Where the gate or gates is or are of smaller cross section than the sprue, the latter will fill rapidly with metal. The difference in level between the metal in the casting and that in the sprue will increase, placing more pres-

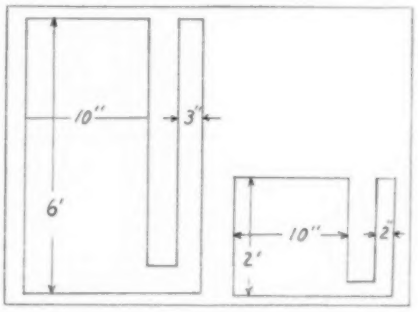

Fig. 221—Metal in a single 3-inch sprue weighs nearly twice as much as the metal in three short 2-inch sprues

sure upon the metal in the gate and increasing the velocity with which it flows into the mold cavity.

This condition is disadvantageous, first because it will tend to cut the sand and second because it will diminish the rate of speed at which the casting as a whole is filled, and especially the rate of speed at which the last metal enters the mold. While the velocity of the entering stream will be increased as the runner fills up, so that at first the quantity of metal entering the mold will be maintained at nearly the proper amount, yet when the runner is full, the velocity cannot be further increased. As a matter of fact it will fall as the casting fills and the difference in level between the metal in the casting and that in the sprue decreases. As a result the last metal will enter the casting slowly and the gate and lower part of the sprue may freeze. Therefore it is apparent that the area of the gates at least should equal that of the sprue.

To present this feature somewhat differently, and perhaps more exactly, the average rate of flow is determined by the size of the gate and the average difference of level between the metal in the sprue and in the casting during

the pouring of the metal in the mold.

If the gate is so much smaller than the sprue that the latter is full practically from the time pouring begins, the flow at first will be proportional to the height of the sprue and at the last will be zero. The average flow therefore will be proportional to half the height of the sprue. If gate and sprue are the same size and capable of carrying the metal as fast as it is delivered from the ladle spout or nozzle, the difference in level between the metal in the casting and the metal in the sprue will be practically uniform throughout.

This level will be the one which suffices to overcome the friction of the flowing metal against the sides of mold, gate and sprue. As the metal grows cold in the casting and the fluidity decreases, this friction will increase, so that the difference in level gradually will increase. Thus the flow will be fairly uniform throughout and a considerable decrease in the rate of pouring toward the end will be voluntary rather than involuntary.

Area of the Gate

The cross section area of the gate or gates should be equal to that of the runner or sprue. In most cases no advantage will be gained in making the cross section of the gates greater than that of the sprue. However, should there be a number of gates whose total cross section is equal to that of the sprue, while individually they may be so small as to invite the danger of freezing, manifestly the total cross section of the group should be increased in the interest of safety in production.

In filling a high casting through a single gate at the bottom, the first metal entering the mold often becomes cold and semisolid and through friction against the wall of the mold greatly retards the speed at which the metal rises. The more slowly the mold is filled, the more pronounced its retardation, hence the necessity for a gate and sprue of comparatively large cross section. If they are small the mold is filled so slowly that the first metal poured becomes very much chilled before it reaches the final resting place. This chilling greatly will decrease the rate of speed at which the metal flows into the mold. The small sprue and gate probably will freeze before the mold is filled.

A high mold requires larger gates and sprues than a low mold of the same cross section with a consequently greater loss of metal scrapped as sprues per pound of casting. For example consider a single casting 10 inches diameter, 6 feet high, requiring say a 3-inch sprue. Contrast this with three castings each 10 inches diameter and 2 feet high, each requiring only a 2-inch sprue as shown in Fig. 221. The weight of the three castings each 2 feet high equals that of the single casting 6 feet high, but the weight of the single long 3-inch sprue is approximately twice that of the three short 2-inch sprues. Therefore about twice as much metal per pound of casting is scrapped in making the single high casting as in making the three short castings.

This brings up the second advantage of placing several gates at different levels in pouring a high casting. If one sprue and three gates 2 feet apart vertically will serve the single 6-foot casting, a sprue only 2 inches in diameter may be used with perfect safety. The lowest gate then is required to feed the metal only so fast that it will flow freely until the level of the second gate is reached. At this stage the pouring practically takes a fresh start at the second section of the casting in which the metal flows in through the second gate. It is no longer necessary to lift the sluggish metal that first entered the mold. The metal in the sprue below the second gate may freeze or not. It is no longer a factor. The new, or second gate will go on delivering metal to the casting. Thus in addition to improving the feeding by supplying practically top pouring, the use of several gates leads to an actual saving of metal scrapped as sprues per pound of casting.

This is the forty-eighth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The forty-ninth installment will appear in an early issue.

THE EDITORS.

Chicago Founders Discuss Code Provisions

The monthly meeting of the Chicago Foundrymen's club, held at the Great Northern hotel Jan. 4, was given over to a discussion of the codes prepared for various divisions of the foundry industry. About 60 members and guests attended, with President D. J. Reese, Whiting Corp., Harvey, Ill., presiding.

Discussions were led by individuals who have been identified with negotiations in connection with the compilation and hearings of the codes. C. B. Magrath, Northwestern Foundry Co., described the important features of the gray iron code, while W. R. Bean, Whiting Corp., presented a resume of regulations applying to the malleable group. Frank L. Hays, Chicago Hardware Foundry Co., treated the nonferrous foundry code in a similar manner.

Some minor differences, relating to wages and permissible number of overtime hours, were noted between the different codes. All of the speakers emphasized the likelihood of a continuation of industrial control in some form regardless of what alterations may be made to the present form of the recovery act from time to time.

Joint Meeting Will Feature Castings

Recent progress in the development and application of gray iron, steel and malleable iron castings to practically all industries will feature a joint district meeting of the American Foundrymen's association, the Cleveland Engineering society and the Cleveland section of the American Society of Mechanical Engineers, in the ballroom of the Statler hotel, Cleveland, Wednesday evening, Jan. 31 at 8 p. m. The program is being prepared with the view of giving engineers the latest available information on the properties of the different types of ferrous castings.

The speakers on the program will include the following outstanding foundry metallurgists: Harry A. Schwartz, manager of research, National Malleable & Steel Castings Co., Cleveland, who will speak on Malleable Iron Castings; Major R. A. Bull, foundry consultant, Chicago, who will discuss Steel Castings; and Fred J. Walls, metallurgist, Eaton-Erb Foundry Co., Vassar, Mich., who will talk on Gray Cast Iron. Dan M. Avey, editor, THE FOUNDRY, Cleveland, and vice president, American Foundrymen's Association, will preside at the meeting.

A foundrymen's get-to-gether will be held in the lattice room of the Statler hotel at 5 p. m. and dinner will be served for those wishing to attend at 6 p. m. The joint committee in charge of the affair is as follows: Frank G. Steinebach, THE FOUNDRY, chairman; J. B. Green, Lucas Machine Tool Co.; R. C. Heinmiller, Foote-Burt Co.; Elmer Lindseth, Cleveland Electric Illuminating Co.; L. H. Mesker, Cleveland Planer Co.; Ralph R. West, West Steel Casting Co.; and John D. Wise.

Appointed Counsel On Electric Cast Iron

T. J. Litle Jr. has been appointed engineering counsel on electric furnace cast iron in the automotive industry for the Detroit Electric Furnace Co., Detroit. Mr. Litle formerly was engineering executive with the Lincoln Motor Co., Detroit, and the Marmon Motor Car Co., Indianapolis, and is a past president of the Society of Automotive Engineers.

Visits Europe

Eric Wisbrun, foundry research and consulting engineer, Cleveland, recently sailed for Europe where he will remain several months. Mr. Wisbrun formerly was connected with the Perfect Circle Co., New Castle, Ind., and the Liberty Foundries Co., Rockford, Ill.

Type MJ Jolt Turnover Draw Machine

Type JDP Jolt Power Strip Machine

Type SB Core Blower

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Chicago, Ill.

Type R Core Turnover Machine

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(*Concluded from page* 12)

blocks. Stone for patching is supplied in slabs 2 to 4 inches thick and approximately 9 x 20 inches in width and length. It is claimed that this material with a fusion point of 3000 degrees Fahr., and a crushing strength of 8000 to 10,000 pounds per square inch, offers maximum resistance to wear and abrasion when exposed to the high temperature in a cupola. It is also claimed that the stone lining offers resistance to the cutting action of the fluxing materials. This results in a fluid slag which readily runs from the bath. The ability to maintain a practically uniform diameter is an important factor in the operation of a cupola on a continuous all day basis.

Prevents Entrance of Iron

Each cupola is provided with a continuous tuyere opening. A ledge projecting inward about 4 inches beyond and above the tuyere line opening prevents the entrance of iron or slag into the tuyeres and also serves as a resting place for the first or lower tier of stone employed for patching the melting zone. The first tier naturally supports those above it and they are not dependent on the plasticity of the clay at the back to hold them in place. Best results are secured with a wood or lead mallet when the stone is rapped into place in a minimum thickness of mud.

A silica stone slag hole has been found a useful adjunct in continuous melting where it prevents air leaks and burning out. These blocks are available in several sizes. In this particular instance the stone is 6 inches square with a 2 inch diameter hole in the center. It is bedded in place at the back of the cupola in the same manner that the tap hole block is bedded in front. The clearance around the block is packed with a 50-50 mixture of fire clay and silica sand.

Metal from the cupola is tapped into a 2-ton ladle which serves the triple purpose of reception, mixer and delivery ladle. A uniform, homogeous iron composition is secured in this manner, first by allowing a considerable quantity of metal to accumulate in the well or crucible of the cupola before it is tapped, and second by tapping the metal from three or four charges into a single ladle.

Under ordinary conditions of plant operation metal is distributed to various sections of the foundry on a fixed schedule, but as every foundryman is aware unforseen circumstances occasionally arise to interfere with the most carefully arranged schedules. Molten iron must be handled rapidly. If for any reason one floor of molds or one section of the foundry is not in position to receive it upon arrival, it must be disposed of elsewhere.

In connection with the disposal of molten iron it is interesting to note a minor innovation in the method adopted for disposal of over iron, that is iron left in the pouring ladles after each *round*. These ladles are uniform in size with an approximate capacity of 250 pounds. With comparatively few exceptions exceedingly hot iron is required to pour the castings, therefore each member of the pouring crew is instructed to empty his ladle completely before taking a fresh supply. Manifestly in practical operation it is impossible to gage the exact amount so that the last drop of iron will be absorbed by the molds on each trip. In doubtful cases prudence also suggests the advisability of holding a small quantity of iron in the ladle rather than attempting to pour an additional mold. Also on long runs of small molds the last iron in the ladle is not sufficiently hot for safety.

Serves Double Purpose

Batteries of pig molds are located at various points near the gangway to receive this over iron. An attendant partly fills each mold with a miscellaneous quantity of small scrap and shot, screenings retrieved from the cleaning room and gangways. A combined sprue and runner, broken from a casting, also is placed in each mold, with the sprue sticking up, as shown in Fig. 5.

This arrangement serves a double purpose. The molten iron flows through the interstices between the scrap particles to form a solid one piece mass. The projecting sprue serves as a handle by which the pig is lifted from the mold instead of necessitating lifting and dumping the mold. The composite pigs later are trucked to the domestic scrap pile in the stock yard. On account of the light weight of the castings made in this foundry the gross returns, sprues, gates, over iron and other miscellaneous scrap including defective castings amounts to approximately 50 per cent of the total amount charged in the cupola.

A comprehensive monorail system facilitates the distribution of molten iron to all the molding stations. A small hoist permits one man to manipulate each ladle. The men are protected by goggles, safety shoes and leggings and through constant practice develop a high degree of ease, speed and skill in covering their respective stations.

The monorail system extends into every department of the foundry and is employed in the transportation of sand, castings and other materials.

This is the first of two articles dealing with methods of procedure at the gray iron foundry of the Electric Auto-Lite Co., Fostoria, O. The second will be presented in an early issue.

THE EDITORS.

A. F. A. Makes Goostray a Life Member

JOB GOOSTRAY, veteran of Hunt-Spiller Mfg. Co., Boston, was the guest of honor at the Dec. 13 meeting of the New England Foundrymen's association held at the Engineers club, Boston. Acting on instruction of the board of directors of the American Foundrymen's association, Dan M. Avey, vice president, who was the speaker of the evening presented Mr. Goostray with a life membership in the A. F. A. in recognition of his long and honorable service to the foundry industry.

A. B. Root, Jr., a member of the gray iron code committee, representing New England interests, reported on the public hearing held in Washington Nov. 10. An outline of all of the various steps taken in regimenting the foundry industry under four principal codes was given in an address by Mr. Avey. He stressed the urgency for united action and cooperative effort, the probable effects of provisions of approved codes and the necessity of securing every element of self-administration for all branches under their codes.

Milwaukee Group Considers CWA Program

"University of Wisconsin's Civil Works Program in Relation to Gray Iron and High Test Iron" was the subject discussed at the regular meeting of the Wisconsin Gray Iron Foundry group held Wednesday, Dec. 20, at the Schroeder hotel, Milwaukee. Prof. Richard S. McCaffrey and Prof. Scott Mackay of the university directed the meeting and discussed the work which has been done since the inception of the CWA program.

To Handle Sales Of Sand Equipment

T. R. Berkeley, Engineering Service Co., Roanoke, Va., will handle sales of the sand separator and blender manufactured by the Royer Foundry & Machine Co., Wilkes-Barre, Pa., in Virginia, North and South Carolina, Tennessee and Georgia. William C. Edgar, Oliver building, Pittsburgh, will represent the company in western Pennsylvania, West Virginia and the western part of Maryland.

Check Reduces Casting Loss

(*Continued from Page* 13)

ing illness. The fact that the sick castings have not been rejected has caused the molder, the coremaker and every person concerned to become more careless and take additional chances. In many instances these sick castings become so bad that they finally land among the worthless dead.

The sickness may be diagnosed as a few sand or blow holes, shrink cavities, cracks, or deformities or other form of defect. The affected area is not in a vital spot and does not affect the strength or durability of the casting.

Why are these castings sick? Because, in most instances, the supervisor or inspector does not direct the molder's attention to them. He decides that the defect is not of a serious character, or, that the casting may be saved by welding or in any other manner. When the molder hears no complaint, he naturally assumes that the casting is satisfactory and he therefore neglects to take any additional precaution on others. The result is that subsequent castings continually become worse, until finally they cannot be saved. Then a post mortem is held. The cause of the defect is determined and remedial measures applied. In the meantime many sick castings have been delivered to the customer.

Incentive for Inspection

Sick castings are more dangerous than dead ones. The sick receive less consideration than the dead, when they really should receive more. In a case of death, the undertaker and not the doctor is the man on the job. For dead castings the undertaker is the cupola man. When a member of a family is sick, a doctor is called in the early stages. The same rule should apply when a casting shows symptoms of sickness.

Sick castings constitute a greater menace than dead castings to a good foundry business. The customer accepts and uses the sick castings, but seldom or never sees or hears of the dead ones. The foundryman has every incentive to inspect carefully all casting defects daily. Small or great, trifling or serious, the cause of each defect should be determined and proper steps taken to correct it *immediately*. In this connection it is advisable to keep a complete daily record of defective castings, the cause in each instance and the name of the molder. Irrespective of age or ability, each man's attention should be directed to his defective castings and —if necessary—he should be instructed on how to prevent the defect. A competent molder or coremaker probably may resent what he considers kindergarten instructions, but he will be ashamed of his work and will be more careful in the future. If he does not know how to improve the quality of his work, he needs instruction. In either case a daily inspection becomes a formidable weapon in cutting down casting losses.

In addition to keeping in close touch with the men responsible for small or great defects, each man's efficiency record will show his standing on the health of the castings he produces. He should receive a greater number of discredits for a sick than for a dead casting.

A defective casting record, even though complete in every detail, is of no value unless it is used promptly to impress on the minds of the men who made the defective castings, that greater vigilance and care are necessary.

Consider some of the characteristics of castings in the sick list. A cylindrical shaped casting is swollen at the bottom because it was cast on end in sand that was not rammed properly, or in a flask that was not strong enough to withstand the strain. The casting passes inspection, because some of the excess metal will be removed in the machining operation, or some may be removed by chipping. It is billed to the customer at the standard weight of a perfect casting. The result is that the foundryman gives away a certain amount of metal for nothing and the customer accepts an imperfect casting.

However, the most dangerous feature is that this strained casting has passed inspection. Unless the molder is checked or instructed immediately to ram the sand harder, or strengthen his flask, he will continue to produce the same bloated abortions, unless the metal actually forces its way through the bottom to produce a dead casting, a piece of scrap.

Some castings are perfect in every respect with the single exception that sand is burned on in spots. A great deal of extra work is required, tumbling or sandblasting, before they pass inspection and are accepted. The attention of the floor, bench or machine molder should be directed immediately to the cause of all this extra work. He should be instructed to use more care in covering his pattern with facing sand. If immediate steps are not taken he will continue to grow more careless and eventually omit the facing altogether with the resulting cut and scabby castings.

May Look Elsewhere

Cause of a sick casting filled with sand holes is a cut on the surface of the mold. The casting is repaired and shipped, but if the sand, or the molder's method of gating, venting or ramming is not corrected promptly, we reasonably may expect the next casting to be a dead one. If not actually dead, the sick castings may be shipped for some time, until the patience of the customer is exhausted. He looks elsewhere for a supply.

The list of sick castings includes those suffering from blowholes, soggy sections, distortions, over size, sand holes, hard spots, cracks, misplaced cores, missing lugs, defective pattern, joint shifts, core shifts, burn downs, buckles, leaks, etc. Close daily investigation of any or all of these defects will result in a decided reduction in the percentage of bad castings and an improvement in the quality of the good ones.

Heroic measures occasionally are necessary, as when a shop is filled with sick castings. Although expensive, the best plan is to scrap every

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Daily Defective Casting Report

Date .....

Workman	Description	Number saved	Weight	Nature of Defect	Workman's Excuse	Cause of defect	Remedy to correct
J. Jones	Cylinder bushing 10482-c	2	2000	Sand holes	Sand too wet	Not properly vented	Place ¼" vents every 3" and 2" from outside of pattern
A. Smith	Transmission case 11662-T	3	105	Crush	Core too large	Flask shifted	Tighten flask pins
G. Farmer	Engine base	1	4000	Blow on flange	Cores too hard	Vents not properly connected to cores	Place vent posts before ramming cope
C. Carter	Diesel engine cylinder head	1	1100	Leaked under test	Cores too hard. Sand too close	Cores too hard Sand too close	Use 10 per cent more open sand in cores. Bake to a rich brown
R. Peterson	Head stock 1442	2	2200	Soggy section and scabs	Ventless cores	Rammed too hard	Keep rammer 3" away from pattern

..... Foreman ..... Inspector

● Note the difference in growth and scaling between protecting tubes of 15 per cent chromium cast iron and one of ordinary white or hard iron. (A) A new tube of 15 per cent chrome cast iron. The sharp letters show the fluidity of the metal. (B) A similar tube after several months service at temperatures up to 1800 deg. F. (C) A hard-iron casting, made from the same pattern and subjected to the same service as the center tube. Note the extreme growth and scaling.

HIGH CHROMIUM CAST IRON

FOR installations at elevated temperatures, High Chromium Cast Irons are rapidly replacing ordinary gray iron and white iron castings because they resist heat, oxidation and abrasion, and are free from growth. One recent report states that after more than a year's continuous service, 14 per cent chrome stoker links "showed absolutely no signs of wear or corrosion and were in as perfect condition as when installed".

Containing from 12 to 30 per cent chromium—the amount depends on service requirements—these alloy irons are free from growth at temperatures up to 1800 deg. F. and are protected against oxidation by the formation of a thin, very adherent scale. Their higher physical properties further adapt them to severe conditions of heat, oxidation and abrasion.

Commercial melting is readily performed in the cupola or electric furnace depending upon the required carbon content and the form of the casting. Let one of our service engineers tell you more about High Chromium Cast Iron.

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(*Concluded from Page* 36)

casting that is not perfect. This method will entail a loss and create a lot of commotion, but certainly it will initiate a movement toward the production of perfect castings. It is recommended as a sure cure for carelessness on the part of all concerned. The method also may prove a boomerang, as instanced on one occasion in costly fashion, in the writer's experience.

Personal friendship on the part of the customer had induced him to accept sick machine tool castings, including a number of large lathe headstocks. After we had made our drive on sick castings and began to ship a much better quality the customer expressed delight and astonishment to find that we could make such excellent castings. He thereupon culled out and returned all the decrepit and crippled castings he formerly had accepted. We had to absorb the loss, but we profited from the lesson later.

The man in charge of casting welfare—to follow the original simile, the casting doctor—not only must be familiar with all phases of foundry operation, but he must be able to talk to the molder, the coremaker, the melter and the chipper in their own language. The men responsible for a sick casting must not be allowed to leave the conference until he is convinced that he is to blame, and has been instructed on how to correct his error. Almost without exception the man will present an excuse, in some instances reasonable, but usually unreasonable if not actually preposterous. The casting doctor's job is to prevent a recurrence of the defect and the incident must not be closed until every person is convinced of the cause of the trouble and is willing to adopt the proper measures to cure it. At least 10 per cent of the excessive cost of operation will be taken care of if the work is handled in the manner outlined.

Special Daily Report

The table on page 36 shows a daily defective casting form that can be used effectively to collect the necessary data. The man in charge of the cleaning room and the casting welfare man should be authorized to give the information under the headings: *Description*, *Number Saved*, *Weight* and *Nature of Defect*. The foreman in charge should furnish the information under the headings: *Workman*, *Workman's Excuse*, and *Cause of Defect*. The casting welfare man and the foreman in collaboration should furnish the report under the headings: *Remedy to Correct*.

Sometimes it is an advantage to have the inspector and cleaning room foreman ignorant of who made the castings, until after they have accepted or rejected them. Thus all tendency to favoritism is avoided.

The foreman is the logical man to receive the workman's excuse, if any. It brings the two men into intimate contact where the foreman can be of distinct help in instructing the man how to improve his practice. The foreman also is best qualified to report the cause of the defect. To know the real cause he personally must visit the scrap pile and examine the sick castings closely. Thus he is brought where he vitally is needed at least once a day.

As an example of how this method of control works out in practice the reader will note that J. Jones made two cylinder bushings which contained sand holes. His excuse to the foreman was "Sand too wet." If he knew his sand was too wet, why did he use it? Apparently he knew the condition of the sand, or he could not make the report. In this instance the foreman found that the mold was not vented properly. The column for that purpose shows that he gave Jones detailed instruction on how to vent the next mold he made.

Item No. 4 shows that Carter produced a diesel engine cylinder head that leaked under pressure. He claimed that the cores were too hard and close. The foreman agreed with him. The remedy was in the form of instruction to the coremaker to change his sand mixture and bake the cores more thoroughly.

Some foundrymen may be inclined to ridicule such an elaborate plan for fighting the defective casting evil. They have no grounds for ridicule unless the quality of their own work is up to standard, or, their defective casting loss is below 2 per cent.

Report Important Developments in Foundry Products at A.S.M.E. Meeting

WIDENED responsibilities for engineers were foreseen by A. A. Potter, dean of engineering, Purdue university, and retiring president of the American Society of Mechanical Engineers, in addressing the fifty-fourth annual meeting of the society in New York, Dec. 5-7.

Having developed the necessary technique for almost unlimited wealth, the engineer, he said, can "no longer afford to stand aside while financiers, promoters and politicians so tragically bungle the problem of its distribution.

"Primarily engineering must deal with the technological problems of research, development, design, production, testing and operation. Yet the engineer is becoming more and more interested in finance, and is to an increasing extent the directing head of industry and of public works."

"Engineering," Dean Potter added, "is inevitably headed toward responsibility for maintaining that balance in the social structure which modern conditions have sometimes so violently upset; also toward active participation in political affairs where clear thinking and courageous action are so badly needed."

Advancement in various phases of mechanical engineering was clearly indicated by convention speakers. Despite pessimistic forecasts in some quarters regarding the economic value of improved machine tools and machine shop processes in the light of certain economic philosophies developed in Washington, the consensus of opinion appeared to be that the machine tool industry stands to benefit.

Like all capital goods industries, the machine tool industry has been one of the most acute sufferers during the depression, but, it was said, with the engineering industry as a whole faced with shorter hours, higher rates of pay, more competitive conditions and a price minimizing which cuts out certain undesirable elements of competition, high quality of product is essential, and this means good machine tool equipment.

It was pointed out that under the competitive leash, the cast iron founder has contributed more during the past 2 years than for many years previously. These developments, it was revealed, have been obtained largely through heat treatment, alloys, carbon control and melting methods. Through these means, high test and special cast irons are being made, some with tensile strengths up to 80,000 pounds per square inch.

Withstand High Temperatures

Alloy irons have been developed to withstand temperature up to 1650 degrees Fahr., contrasted with plain irons which begin to grow at about 650 degrees Fahr. These alloy irons have found special application in the production of automobile brake drums, cam shafts and crank shafts. A big advance in specifications has been made by the adoption by the American Society for Testing Materials of tentative specifications for plain iron.

Betterment in the melting and heat treating procedures has been obtained by steel casting producers as a result of experimentation in the production of low alloy steel castings. A committee of the American Foundrymen's association, it

(*Concluded on Page* 40)

IMPROVEMENT

STEADY CONSTANT IMPROVEMENT

RESEARCH in the laboratory—research out on the grinding lines—has taught us much in this important business of cleaning room practice in the foundry. The result has been a constant steady improvement on both our high speed Redmanol bonded and the low speed vitrified grinding wheels.

There has been much in the way of manufacturing refinements—uniformity of wheel structure—balance between grain and bond—in bond density—in grain treatment.

And all of these improvement studies are evidenced in the keenness of Aloxite and Carborundum Brand Snagging Wheels—in their ability to cut with speed—to show long life—to create a state of improved grinding conditions and lowered grinding costs.

It is also significant that this research has developed new types of wheels for special foundry grinding applications. Further data on request.

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(CARBORUNDUM AND ALOXITE ARE REGISTERED TRADE MARKS OF THE CARBORUNDUM COMPANY)

(*Concluded from Page* 38)

was stated, is evolving for presentation to steel casting makers a classification scheme based on chemical composition and intended to eliminate confusion among buyers. Plain carbon and special alloy steel castings, it was brought out, are now being produced commercially with tensile strengths ranging from 60,000 to 200,000 pounds per square inch, and at the same time permitting a degree of ductility and shock resistance adequate for any prescribed purpose.

Satisfactory results were reported by producers of malleable castings, under the recently adopted dual specifications of the American Society for Testing Materials. Special irons have been developed which, with a pearlitic or sorbitic base and temper carbon, give considerably higher tensile strength, and permit of special heat treatments for localized hardening for wear resistance.

Develop Tests for Bung Brick

(*Concluded from Page* 14)

information with a minimum of tests, ties up the least number of bung frames and requires minimum attention of the furnace man. The four methods are as follows:

No. 1. Purchase outright a sufficient number of new brick to maintain bungs over a period of several months. Then by checking the costs resulting from using the new brick with the costs produced by the brick normally in use, a decision can be made as to the quality of the new brick.

No. 2. Build complete bung frames of the test brick and compare with complete frames of the regularly employed type.

No. 3. Construct one half of the frame, parallel to the furnace width, of the test brick and the other half of the regular brand.

No. 4. Build a frame having alternate panels, across the furnace, of new and regular brick.

Requires Considerable Time

The first method seldom is used since it incurs risk of financial loss and also requires a great amount of time. The second method requires less time and fewer brick, but the ultimate results not always are dependable. The main objection to the method is that no two bung frames, and hence neither of the two types of bricks under test are the same distance from the burner. Since practically all spalling occurs when the furnace is lighted off, it is obvious that the location of the bung frame in relation to the burner has considerable bearing on the test.

The third method is not entirely satisfactory as the service conditions across the entire width of the furnace are not uniform. This may be due to an increase in thermal shock on one side of the bung or a variation in erosion or melting which may occur when the flame is deflected by the charge or faulty burner arrangement.

The fourth method is best because it requires fewer test brick, subjects the test brick to more uniform service conditions, and any differences between the two tests can be seen at a glance. However, the size of the panel is important. A test was made comparing two different brands of brick, using panels of four 2⅞-inch courses in width. While the results were fairly satisfactory, the panels were too narrow, allowing the failure of one panel to affect adversely the bricks in the adjoining panel and vice versa. Accordingly the width of the panels was increased to five 2⅞-inch courses, as shown in the accompanying illustration.

The fourth method of testing accommodates standard practice as most air furnaces are of such a width that eight 5 course panels can be installed across the bung. The bungs used in the test described are 31 inches deep, which is greater than those ordinarily used. The more common practice of laying up frames 13½ inches deep, using the standard 13½-inch, No. 105 bung brick, affords an opportunity of scattering test frames well along the charging section of the furnace. One hundred test bricks used according to method 4 are sufficient for the construction of four or five test bungs and a comparison of two brands of brick.

Hammond Speaks At Chicago Club Meeting

Features of the NRA as well as foundry practice occupied the attention of the Chicago Foundrymen's club at its monthly meeting held at the Great Northern hotel, Dec. 7. Gen. T. S. Hammond, president, Whiting Corp., Harvey, Ill., spoke on some of his observations made at Washington while serving as chief of the NRA trade association division and previously as executive director of the federal re-employment program.

Industries generally favor a continuation of their codes because of the benefits contained therein, despite considerable dissatisfaction over section 7a of the recovery act relating to labor, he stated. Headway is being made in working out the many complications inherent in the codes. General Hammond urged that ways and means be found for handling the controversial subject of employe relations rather than to oppose the NRA in its entirety. He expressed the opinion that the trade associations are the best vehicle through which compliance to the codes is obtainable and urged the various bodies to qualify themselves to serve as code authorities, a function being taken over by various local compliance boards which the government is setting up.

Louis Rasmussen, foundry manager, Nash Motors Co., Kenosha, Wis., discussed general foundry practice employed by the company in the casting of engine blocks and other parts. The automotive foundry, he pointed out, must satisfy the engineering department, machine shop and car buyer, and occasionally conflicts arise through requirements of these groups. A hard iron that is satisfactory for maintaining long life of the engine may produce difficulties in machining.

Composition of the hard iron produced by the Nash company contains about 3.40 carbon, 2.10 silicon, 0.18 to 0.20 phosphorus and 0.60 to 0.80 manganese, according to Mr. Rasmussen. Brinell hardness of cylinder blocks averages 180 to 185 in the bore. Hardness tests are made at the bore before machining. Tensile strength of the hard iron varies from 38,000 to 40,000 pounds, with the soft iron around 28,000 to 30,000 pounds. Molding sand receives frequent checks for permeability, moisture and strength, tests being made every 20 minutes.

Samples of cylinder block, head and manifold castings were displayed by the speaker, the block being sawed in two to demonstrate the intricate details of the casting. Samples of manifold cores made without wires or vents also were shown.

D. J. Reese, Whiting Corp., Harvey, Ill., was elected president of the Chicago club for the coming year, succeeding Gottfrid Olson. Other officers selected include: Vice president, William Cureton, W. A. Jones Foundry & Machine Co.; secretary-treasurer, W. G. Gude, The Foundry. The following directors also were chosen: R. E. Kennedy, American Foundrymen's association; E. K. Smith, Electro Metallurgical Co.; T. J. Magnuson, Champion Foundry & Machine Co.; Gottfrid Olson, Beloit Foundry Co., Beloit, Wis.; L. J. Wise, Chicago Malleable Castings Co.; D. E. Clifford, Hickman Williams & Co.; James Thompson, Hubbard division, Continental Roll & Steel Foundry Co., East Chicago, Ind.; and W. H. Parker, American Steel Foundries.

The Federal specification board recently has developed a proposed revision for the Federal specification for ferrotitanium.

Compiles Jobbing Shop Rate Data

(*Continued from Page* 15)

data are built in form most simple to use, accurately evaluating conditions and variations.

A series of detailed time studies is taken over the range of sizes. It is desirable to obtain studies on extremely large or small as well as on medium or average size jobs. The number of studies to be taken depends upon the judgment of the engineer compiling the data. It is a good plan to get as many studies as time permits since resultant charts will be more accurate.

As soon as possible after starting a series of studies, the standard elements in this class of work should be determined. This serves as a guide in taking studies that all may be detailed along similar lines, to the end that the study information may be in suitable form for future analysis. Each study is given a code figure, the time study engineer's estimate of the general working efficiency of the operator.

Normal Working Value

Each element value shown on the time studies is adjusted for coding to what may be termed a normal working value. A percentage also must be added to cover normal relaxation time required on this class of work. The adjusted figures for each study then are posted to comparison sheets with description of the job, dimensions, etc. Comparison sheets may be omitted on simple work, but usually are useful in that they make study figures and information more readily available for future analysis.

As the work proceeds the engineer should predict as nearly as possible the form in which the final data is to appear, so that he may develop element values in form to be applicable to final chart form. Each standard element is analyzed and correct values selected. For example, the time to fill a flask with sand varies with volume. The study figures may be assembled in order of flask volume, or plotted to graph paper. Values selected are based on observation, or a selected curve may be established. Element values vary with area, length, volume, depth, perimeter, or combinations of these factors. In some cases they are found to be constants.

Having determined all standard element values, they are assembled to chart form as shown in the accompanying table. Taking any point on the illustrated drag chart, this assembly is a question of adding up the values for that point of all elements which apply to that chart. In putting the chart in final working form it is customary to round out the individual figures to some extent.

Operations not included in the chart values as standard elements must be analyzed. These added or miscellaneous values are determined and put in usable form.

Proof of the data is the finishing touch. A value is built for each study by use of the charts and compared with the summation of the study values. This should bring to light any errors in analysis, figuration or assembly of charts. Where practical, an operating check should be made, building values for jobs in production and comparing chart values for each day's run with the engineer's estimate of the operator's efficiency. The final test is to apply the data to routine operation. The engineer should check results until he is convinced that the charts give adequate and consistent allowances. Although adjustment of chart values may be required, it seldom is necessary when the charts have been developed by an engineer experienced in this type of work.

The best procedure in applying the data to shop routine is to select a representative of the shop, one well versed in shop methods and practice, whose duty is to specify how jobs are to be made, size flask to be used, cores, gating, nailing and so on required. The standards department man, or rate setter merely has to obtain this information from the shop representative, fill in values according to the standard data and issue the standard. The use of forms on which to record the information necessary for setting standards, with pattern name and number, customer's name and any other required information usually facilitates the work. One of these forms, known as a specification sheet, is shown in Fig. 1.

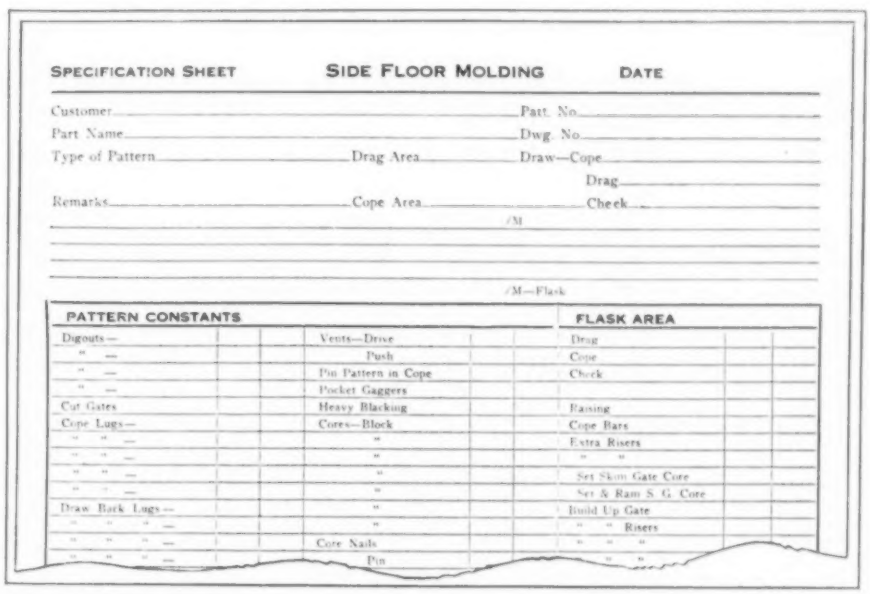
Factors are applied to various component or total values to adjust abnormal conditions. For example some patterns of a complicated nature require special tucking, or draw is difficult, or excessive touchup is required, etc. Extra allowance must be added to cover these conditions. Productive factors are applied to cover long run jobs, since an operator will pick up speed in such cases.

Evaluate Jobs Quickly

Advantages of using data for standard settings include: Accurate allowances may be determined with a minimum of time and expense. Jobs which require hours or days may be evaluated in a few minutes. Any intelligent man, accurate at figuration may be trained to carry on the routine work. Standards may be determined before the job is started in the shop. Standards prove remarkably consistent. Where question arises as to the most economical process to use, predetermination of standards in many cases has given the answer. Estimating productive cost on prospective business. Standards are set by use of blue prints of the required equipment. Extension of these standards at current wage scales accurately predetermines cost of production and serves as a basis for the quotation to be submitted.

In a shop handling heavy jobbing castings it is considered satisfactory if data are developed to cover 90 per cent of the productive work. Special jobs or odd jobs made by trick or seldom used methods, of course cannot be evaluated without a check of the

(*Concluded on Page* 43)



SPECIFICATION SHEET — SIDE FLOOR MOLDING — DATE

Customer ____ Patt. No. ____
Part Name ____ Dwg. No. ____
Type of Pattern ____ Drag Area ____ Draw—Cope ____
Drag ____
Remarks ____ Cope Area ____ Cheek ____
/M

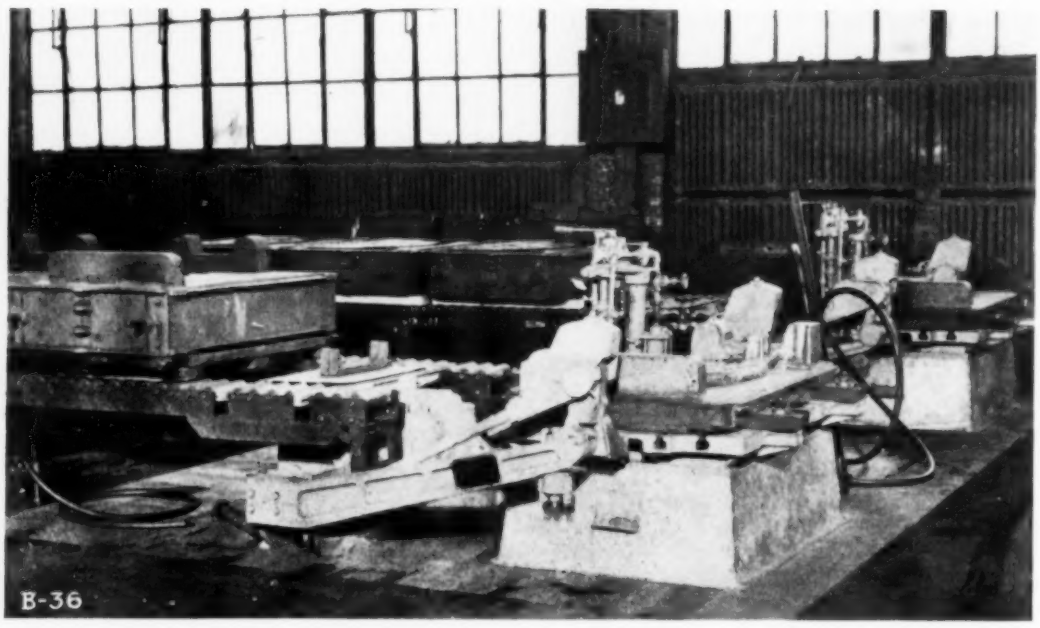
/M—Flask

PATTERN CONSTANTS			FLASK AREA
Digouts—		Vents—Drive	Drag
" "		Push	Cope
" "		Pin Pattern in Cope	Check
" "		Pocket Gaggers	
Cut Gates		Heavy Blacking	Raising
Cope Lugs—		Cores—Block	Cope Bars
" " "		"	Extra Risers
" " "		"	" "
" " "		"	Set Skim Gate Core
" " "		"	Set & Ram S. G. Core
Draw Back Lugs—		"	Build Up Gate
" " " "		"	" " Risers
" " " "		Core Nails	" " "
" " " "		Pin	" " "

Fig. 1—Preliminary information on which to base the standards is collected on a specification sheet with spaces for practically every item that may be encountered

IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

HERMAN MOLDING MACHINES



~1934~

A new year and new conditions to be met in the industry. As before, our trained engineers are ready to help you with your molding machine problems.

Perhaps you do not have molding machines or yours may be of obsolete type. The new Hermans are designed and built for present day conditions. They are fast, accurate, and rugged. Note their sturdy construction. Built of castings they will give years of complete satisfaction.

WRITE FOR BULLETINS

HERMAN PNEUMATIC MACHINE COMPANY

GENERAL OFFICES: Union Bank Building PITTSBURGH, PA.

MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.

Foreign Works: Pneulec Limited, Mafeking Rd., Smethwick, near Birmingham, England
Hartung Aktiengesellschaft, Berlin, Lichtenberg, Germany
Gibson Battle & Co., Limited, Sydney, N. S. W.

(*Concluded from Page* 41)
individual job. That a wide variety of work may be covered satisfactorily is indicated by the following on which data have been established: Making all types of small and large cores. Blacking and assembling dried cores. Bench molding, loose or mounted patterns. Green sand floor molding, loose or mounted patterns. Regular type dry sand floor molding (drag and cope flasks). Dry sand cylindrical jobs, drags, copes, cheeks, and cores made with cylindrical patterns and molded vertically, belts, drums, cylinders, etc. Dry sand jobs swept from spindles. Chipping and cleaning castings. Various special classifications.

Chromium Alloys Steel Castings

(*Concluded from Page* 18)

rosion and heat-resisting steels will be divided into three groups, those containing from 12 to 16 per cent, 17 to 20 per cent, and upward of 20 per cent chromium. A typical set of figures indicating the physical properties of each of these grades is included in Table V.

The effect of chromium in increasing the corrosion resistance of steel is evident at about 4 per cent chromium. An important class of steel for that service containing 4 to 7 per cent chromium has been referred to previously. At about 11 per cent chromium there is a marked increase resistance as to create an important class of commercial corrosion-resisting steel containing 12 to 14 per cent of that element. Castings of that steel are highly resistant to corrosive action by fruit juices, hot lubricating oil, vinegar and vegetables, also basic materials such as lime and caustic soda. Valves have given excellent service in high-pressure steam and hot oil transfer lines.

Resist High Temperatures

Corrosion resistance is still further improved by increasing the chromium content to about 18 per cent. Castings in that class have given good service in the form of pump valves, valve trim, superheated steam lines, resistance to sea water, hot oils, foodstuffs and alkaline solutions, both hot and cold. Steels of still higher chromium content are used more particularly to resist extremely high temperature conditions, as in the handling of hot gases.

Resistance to oxidation at elevated temperatures improves in a somewhat lineal manner up to about 11 per cent chromium and is increased to a marked extent by still larger amounts. The 12 to 14 per cent chromium castings can be used successfully for long periods of time in heat interchanges, furnace parts and similar equipment at temperatures up to about 1400 degrees Fahr. Those containing about 18 per cent chromium function well at temperatures up to 1650 degrees Fahr., but where resistance to scaling is required, steels containing upward of 20 per cent and in some cases up to double this amount of chromium are much to be preferred. Their resistance to scaling is good up to 1800 degrees Fahr. and often to as high as 2000 degrees Fahr.

Notable applications for that class of steel may be found in supporting disks in steel heat-treating furnaces, waste-heat recuperators, superheaters containing corrosive gases at high temperatures, rolling mill guides, retorts to regenerate bone char in the sugar industry, pug-mill blades, tubes, hangers and saddles in the cement industry, for handling mixed acid solutions in the manufacture of gunpowder, and in resistance to acid mine water.

One of the difficulties heretofore encountered in the casting and use of steels containing over 20 per cent chromium is the tendency toward large columnar grains in the castings, and toward grain growth when held at high temperature for long periods. The first difficulty has been entirely overcome and the second materially reduced through the addition of appropriate amounts of nitrogen.

Nitrogen is added through a special high-nitrogen ferrochrome, and must be present in the steel to the extent of 1 part for every 100 of chromium. Nitrogen increases the strength and toughness materially and the hardness slightly, but without detrimental effect on machinability. The striking effect is well illustrated in Fig. 2 which shows steels from heats as identical as possible in all respects except one that contains fine crystals. This received the nitrogen treatment.

Figures in Table V compare the physical properties of two 25 per cent chromium castings, one containing normal and the other the special amount of nitrogen. The marked increases in ultimate strength and yield point easily are apparent, but particular attention is directed to the figures for elongation and reduction of area which, in the nitrogen-treated steel, are approximately double those of the steel with ordinary nitrogen content. These figures are for the *as cast* condition and could be somewhat improved by proper heat treatment.

Add Nitrogen

LISTS of comparative figures illustrate the physical properties of two 25 per cent chromium steel castings, one containing normal and the other special amounts of nitrogen. The marked increases in ultimate strength and yield point easily are apparent, but particular attention is directed to the figures for elongation and reduction in area. Those for the nitrogen treated steels are approximately double those for steel with ordinary nitrogen content. The figures are for the as cast condition and could be improved to a certain extent by proper heat treatment. This article is from a paper by J. H. Critchett, vice president Union Carbide & Carbon Research Laboratories, New York, which was presented before the Chicago convention of the American Foundrymens association.

Discusses History Of Iron Manufacture

Rex Jennings, manager, Frank Foundries Corp., Moline, Ill., addressed the regular meeting of the Quad-City Foundrymen's association on Monday evening, Dec. 18, at the Davenport chamber of commerce, Davenport, Iowa, on "Castings; Yesterday, To-day, and Tomorrow."

The speaker discussed the iron of early civilization, describing some of the first furnaces used to manufacture iron, He also described the basic operations of producing iron from ore both in years past and at the present time, and told how some of the old furnaces still are in operation in certain parts of the world. He spoke of cast iron of today and stated that the product itself depends on the shop, men, methods, and other factors of manufacture. Mr. Jennings also painted a picture of the future of the iron industry, stating that constant study would be needed to compete with other products.

The membership committee reported that the total membership has surpassed that of last year by a considerable number. Harry N. Henninger, president of the association, presided.

The next meeting will be held at the LeClaire hotel, Moline, Ill., to discuss "Bronze Casting."

Foundry on Island of Madeira

(*Concluded from Page 20*)

mules or oxen. This system is still used to a considerable extent.

As in practically every other part of the world, the motor car has taken hold and now several hundreds are running. New roads are under construction and old roads are widened to take these vehicles. A type of small char-a-banc has been put on the road and the country people now are being educated to the luxury of riding. The road surfaces are primitive, paved with large beach pebbles or broken rock, of which there is an abundance. For this reason a law specifies that all cars must be provided with balloon tires.

The road surface is fairly durable. The roads never are subjected to frost or snow, and with exception of two or three months in the year to little rain. Some of these roads are cut through the solid rock and often run along the edge of a precipice with a sheer drop of hundreds of feet. Some strength of nerve is required to motor here. I was scared stiff on the first few runs, but one becomes accustomed to these conditions in a remarkably short time.

Pike Peak Type Railway

A quaint old rack and pinion railroad, one hardly can call it a railway, run from the city of Funchal to Terreiro da Lucta a spot in the mountains used mainly by passengers from the mail boats whose stay in Madeira is of short duration. From this spot 3300 feet above sea level there is a glorious view of the bay and city. One of the chief attractions of the trip is the return journey generally made in a toboggan in which two or three persons are carried. The toboggan is steered by two men who run behind with guide ropes fixed one on each side. Considerable speed is attained on some of the slopes and the thrill is well worth while.

Industries of the island include wine making, hand embroideries, wicker work, etc., and quite a lot of agricultural work in the cultivation of vines, bananas, sugar, fruit and vegetables. Several of the large business houses are owned by foreigners with ownership extending back through many generations. One of the foremost is Leacocks with branches in New York and London and interests in most of the industries of Medeira. This company owns the foundry and engineering works, cigarette and tobacco factory, wine stores, embroideries, etc.

The foundry is quite small compared to many modern plants of today, but only a small number of foundries are called upon for such a variety of castings, including all running repairs for all types of plant and machinery.

Jobs recently executed include remodeling and equipping a cooperage plant on more or less modern lines, and building a wireless station for the Marconi Co., in ferroconcrete.

We have supplied and erected several Pelton wheels. These jobs nearly always are out in the wilds. These wheels are used for driving saw mills by day and are switched over to grinding wheat and mealies at night. We have equipped a cement works on one of the neighboring islands (Porto Santo) about 6 hours steaming in a small coasting vessel from Funchal.

We supplied the gear for a ropeway in an awful place. Boiler, winding engine, towers, etc., all had to be packed into parcels not exceeding 100 kilos (220.46 pounds) as the whole lot had to be manhandled 1500 feet up precipitous cliffs.

With respect to the general work of the foundry, duties are high on imported material and thus we are enabled to turn out a certain amount of commodities for local consumption, such as nigger pots, bedsteads, saucepans, frying pans, kitchen ranges, wrought iron gates and railings, etc., but the most of the work is of a jobbing nature. Labor is fairly cheap but not of the highest quality although many of my boys have developed into fairly competent mechanics. The different trades are not so distinct as in other countries or even in Portugal itself. An intelligent lad can be trained to the lathe, planer or shaper, to the fitting bench and at a pinch he can turn to a job of molding or smithing as required. This is convenient and they are keen to learn.

The foundry represents but a small section of the activities of the company, and only accounts for about 10 per cent of the employes.

We operate three cupolas of a non-descript design, made in the works. The largest has a capacity of 3 tons, the second, 1½ tons and a small cupolette for emergency jobs. Brass is melted in coke fired crucible furnaces. The foundry is served by an overhead electric traveler and small hand cranes. The works are run on electric power with motors for each shop, but in the joinery works most of the machines are self contained with separate motors.

We have made several castings of over a ton, but these are rare. Sugar mills rolls and frames are our largest jobs but this work is falling off owing to the closing down of many of the mills, due to a new law which does not permit the manufacture of alcohol only on a very limited scale.

In the nonferrous foundry we produce brass, gun metal, copper, and aluminum castings, mostly for use in our own productions. Also a fair amount of bell casting for the various churches.

Among our general products are kitchen ranges, bedsteads, three legged nigger pots in which the country people cook their food, cast iron frying pans, gulleys, manholes and frames, a certain number of lamp columns, and cast-iron galgeries. We cast about 3 tons once a week.

Engineer To Represent Electric Furnace Company

Maj. R. A. Bull, consultant on steel castings, 541 Diversey parkway, Chicago, has been engaged by the Ajax Electrothermic Corp., Trenton, N. J., to devote part of his time as its consultant and representative in the middle west. Major Bull was director of the Electric Steel Founders Research group during the 13 years that the organization was in existence, and has had wide experience in steel founding, gained as a manufacturing executive with the American Steel Foundries, Commonwealth Steel Co., Duquesne Steel Foundry Co., and other companies.

Major Bull is a past president of the American Foundrymen's association and in 1927 was awarded the Joseph S. Seaman gold medal for his many contributions to foundry progress. He is a member of numerous committees of the American Society for Testing Materials, the American Institute of Mining and Metallurgical Enginers, and the American Society for Steel Treating. He is also a member of the American Iron & Steel Institute, the British Iron & Steel Institute, the Army Ordnance association, the American Welding society and other technical organizations.

Hold Code Hearings

Public hearings on the codes of fair competition for several groups, either within the foundry industry or closely related to it, were held during the past month. Included in that group are the following: Foundry supply industry, Dec. 14; porcelain enameling industry, Dec. 20; die casting industry, Dec. 20; chilled car wheel industry, Dec. 20; galvanized ware industry, Dec. 19; hand chain hoist industry, Dec. 18. The code for the oxyacetylene industry has been approved and became effective on Dec. 18, and that of the valve and fitting industry became effective on Dec. 25.

36½% of Royer Business Repeat Orders

Model "C"-2

Among the hundreds of foundries now using Royers, a great number (including many of the leaders of industry) are using from 2 to 23 of these machines. In nearly every case they started with one Royer. These continual repeat orders are the highest testimony of satisfaction, saving and service.

Thoroughly aerated sand has reduced their percentage of defective castings; thoroughly blended sand has given them clean and uniform heaps at all times; speedy sand conditioning has saved them much time and money.

It will pay you, too, to install a "Royer". Investigate!

The ROYER SAND SEPARATOR AND BLENDER

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The busy man spurns the tempter

The Adventures of Bill

BY PAT DWYER

ON ONE of his idle days recently Bill walked up the gang plank and into the galley where I sit figuratively chained to the oar from rosy morn to dewy eve. At this time of the year the morns are not particularly rosy according to what I have been told by unfortunate but reasonably reliable witnesses. A stickler for the truth, one of these aggravating creatures ever on the alert for a chance to throw sand in the bearings if one essays a modest flight into the realms of imagination or hyperbole probably would balk like a spavined mule at the term dewy eve, but what of it? The phrase is applicable at certain seasons of the year and I have been minded to use it on more than one previous occasion. In a reasonable spirit of give and take I am willing to admit that the phrase is not quite apropos at the moment. It is a little late for the past season and rather early for the coming season, but taking it by and large and on a yearly basis it is sufficiently accurate. The alert and intelligent reader will experience no difficulty in taking my meaning, viz.: that in the matter of diligence, concentrated mental and physical effort I might serve as a shining example, a pace maker to the ant, the bee and the beaver, hitherto considered champions in the field.

"My busy day," I explained to Bill. "What brings you down town today? Please be brief. Whatever the reason may be, I am inclined to the opinion that it is of little or no importance. If you were in my position, constantly battling against time—"

"Some battler," Bill observed, calmly settling himself in the visitor's chair. "Far be it from me to criticise the stance of any warrior—"

"Thank you my lad. Thank you. Warrior is a better word than battler. More dignified and more in keeping with the character of my activities in the battle for life."

"Exactly. That's the kind of a warrior I had in mind. 'He lay like a warrior taking his rest with his martial cloak around him.' True you have no martial cloak, but otherwise, especially the big hoofs cocked up on the desk, the resemblance is perfect. Some day, unless you display a little more acumen than I am inclined to give you credit for, old Father Time, the venerable gent with the beard and hour glass will sneak up on you with his scythe and just naturally nip that swivel chair from under you and leave you hanging by the heels on the desk.

"However, since neither one of us is doing anything today—tut, tut, don't perjure your immortal soul—I propose we take time out to visit a certain department store which is featuring a display of many rare and curious objects."

"If you will pardon my curiosity, I should like to know what you propose using for money on this expedition."

"What do you mean, money?" Bill snapped his fingers. "We're not going to buy any of these things. Just going to look at 'em. I presume they are all locked up in glass cases or guarded in some equally efficient manner to curb the activities of collectors and other light fingered gentry who might be tempted to cop, lift, cabbage, snag, purloin or otherwise seek to acquire title to any of the objects by right of discovery and capture. The exhibition marks—le's see what it says on this paper—the 35th anniversary of the store's opening in this town and most of the exhibits are connected in some manner with the year '98 or earlier."

"You can count me out," I declared firmly. "It may suit you, but I have no desire to get mixed up in a fight when some lad starts to recite, 'Who fears to shpake of ninety-eight!' "

"Don't be so dumb," Bill admonished me kindly. "This is a different '98. 1898 to be exact, or, as it is popularly known, one of the gay nineties. Here, let me read you the list of objects to be seen and I miss my guess by a long sea mile if you will not be as curious as I am to look 'em over:

Reproductions of all the famous diamonds of history; hand carved pipes; playing cards; rare and beautiful books; mens hats and suits; women's clothing; rayon; dolls in all ages; venetian glass blowers; curtains; tapestries; evolution of the lamp; evolution of the telephone; newspapers; electric freighter; stuffed birds; linotype machine; peasant embroidery; street car models.

"Now that I have examined the list

The old guard debates whether it is better to die or surrender

more carefully," Bill admitted, "I find that the stuff is scattered all over the store from the first to the sixth floor. That means we'll have to walk about 40 miles more or less. A little exercise will do you good. Le's go."

Arrived at what I believe is known technically among explorers as the base of operations I was at a loss for the moment to know where to begin. Apparently miles and miles of aisles thickly populated with women extended in every direction. My shopping experience is decidedly sketchy and consists mostly in standing outside while the party of the second part does all the gallant battling on the inside. Confronted suddenly with the prospect of forcing a way tc an invisible goal through this mass of femininity, I suggested to Bill that he should dive into the jungle alone. I should hold myself in readiness to give the alarm, insert an advertisement in the lost and found column of the various papers, or call out the troops in the event he did not apepar in a given time.

"Pack up the old white feather," Bill said, "and forget this mob. You are quite safe. Out in the desert I don't say but perhaps a cross eyed woman might favor you with a second glance of appraisal or amusement, but in here with bargains to right of 'em, bargains to left of 'em, bargains in front of 'em, you would not attract attention if you stepped out of a Hollywood band box with marcelled hair and an English accent."

"My word, old chap. I say y'know that's coming it rawtheh strong. What I mean to say a band box with marcelled hair and an English accent! Just a moment while I add this extraordinary item to my collection of notes on 'American idiosyncrasies.' "

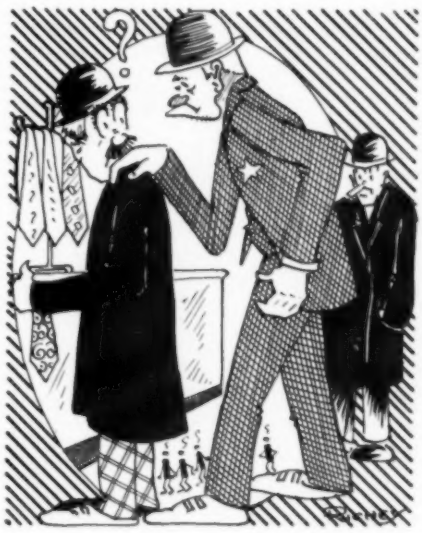
"Can the silly chatter before one of these here now floor walking guys hands you over to the store dick. 'Hah!' this eminent gent says, placing a large red paw on your manly shoulder, 'Hah! The voice may be the voice of John Bull, but the puss came from where the river Shannon flows.'

"That peculiar twist or warp in your mind which leads you to find meanings never intended in a plain statement reminds me of an inquiry I had the other day from a man who had trouble in casting a straight flat plate."

"Why bring that up here? I thought we came to look at an exhibition."

"The exhibition can wait. This man I am telling you about wrote that he had a bolster plate to make for a press, a flat cast iron slab 1½ x 23 x 53 inches finished size. He wanted to know how much extra thickness he should allow on the pattern for warpage in the casting. What is the best ageing process to insure a perfectly flat plate after it is machined. Will the addition of nickel or other alloy improve the casting. He is under the impression that ageing of castings may be accelerated by submitting them to changes of temperature ranging from 150 to 200 degrees Fahr.

"With a straight pattern and with proper molding practice the plain slab casting to which he refers will not warp. Therefore there is no need of thickening the pattern either at the ends or at the center to forestall a form of defect that lies within the province of the foundry to prevent. If this particular casting warped in a former experience, the warping was due to the fact that one side cooled before the other.



His act gets a great big hand

"In ordinary foundry practice with wood flasks, the cope is removed as soon as possible after the casting has solidified to prevent the flask bars from burning. Thus the cope face of the casting exposed to the atmosphere cools more rapidly than the drag face resting on, or in intimate contact with a bed of red hot sand. As the upper face contracts it pulls toward the center and lifts the ends. Under other conditions where the lower face cools first the pull is in the opposite direction and the ends of the casting will be pulled down. In either case the second face contracts later than the first, but by that time the first face is too rigid to be pulled back and the second face cools in a state of tension.

"The ideal method would be to mold the casting in an iron flask and leave the casting in the flask until it has cooled, which in the ordinary jobbing shop means until the following morning. However, fairly satisfactory results may be secured in a wood flask where the cope is rapped before it is removed so that all the sand remains on the upper face of the casting. Where the cope is shallow it may be advisable to heap additional sand on the casting and pat it down with a shovel to approximate the same density of sand on the top as on the bottom of the casting.

"Other alternative methods include (a) digging a channel under the central part of the casting to cool that section before the ends, and (b) removing the casting from the mold immediately after it has solidified and setting it up on edge so that it may cool uniformly on both sides.

"The usual machining allowance on a casting of the kind outlined is 3/16-inch. Thus if the casting is to be machined on both faces, one roughing and one finishing cut, the pattern thickness will be 1⅞ inches, or 1 11/16 inches if machined on only one face. The usual allowance for contraction must be allowed on the width and length in addition to the machining allowance, if the casting is to be machined on the ends and sides. Thus the width of the pattern will be 23 + ¼ + ⅜ or 23⅝ inches. The length will be 53 + 9/16 + ⅜ or a total of 53 15/16 inches.

"The foregoing explanation automatically eliminates any necessity for supplying an answer to the second and third questions. However in the event that the information might be of service in connection with other or related problems it may be said that a temperature of at least 1000 degrees Fahr., and in some instances even higher, is required to remove the strains and tension to which gray iron castings sometimes are exposed in the cooling process before they leave the molds.

"Warped castings in some instances are reclaimed in the following manner. The casting is heated to a bright red and then subjected to pressure either from weights or jack screws. If weights are employed a pier or resting place must be provided to prevent the affected part of the casting from dropping too far. The casting will spring back a certain distance after the weights or jacks are removed.

"Usually the casting is forced in the opposite direction, half the total warpage. For example where a casting is humped 1-inch above the center of a straight line, the pier is arranged to receive it when it drops ½-inch below the line. When the weights are removed the cooled casting will spring back ½-inch.

"Advantage of the jack screws over the weights is that the casting may be set up against the wall, steel columns, large weights, or any other firm stationary object, and the pressure exerted horizontally. A considerable degree of actual experience is required to gage the exact distance a casting should be pushed.

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Galvanizing Malleable Castings

(*Concluded from page* 19)

sand is not all removed by tumbling, a part of the muriatic acid may be replaced by hydrofluoric acid.

In some of the recent articles on galvanizing, production of dross in large quantities has been laid to large accumulations of iron salts due to using pickle baths too long. This has not seemed apparent in galvanizing malleable pipe fittings and in a 10 days' test run a rough check was obtained which showed the same amount of dross produced in the first 5 days as in the second 5 days, though the weight galvanized was respectively 42.4 tons and 38.8 tons. This difference (about 9 per cent) is not conclusive as the manner of drossing the kettle will frequently make that much variation. The amount of iron chloride ($FeCl_2$) in the pickle at the end of the second week was found to be 55 per cent greater than at the end of the first week.

In that test, about 220 gallons of water, 12 carboys of 20 degrees muriatic acid and about 10 gallons of commercial hydrofluoric acid constitute the initial mixture and the capacity of the wood tank used was such that 3 barrels of pipe fittings were in the pickle at the same time.

It required 20 to 30 minutes to pickle, depending upon the temperature and acid strength. The acid was strengthened each morning by addition of 2 or 3 carboys of muriatic acid and 10 gallons of hydrofluoric acid, the total amount of acid being 36 carboys (4140 pounds) of muriatic and 2 barrels of hydrofluoric. This is about 51 pounds of 20 degrees Be' muriatic and about 12 pounds of hydrofluoric per ton of fittings. Test samples drawn after each day's run were checked in the laboratory and the results are shown in the accompanying illustration.

Experience shows that the pickle tank can be operated on that basis until about 50 carboys of muriatic acid have been used and approximately 110 tons of fittings pickled. At which time the iron salts in the tank will be approximately 400 grams per liter, figured as $FeCl_2$. When a tank of pickle like this is dumped with a free acid strength of 80 grams per liter there is a loss of about 7 carboys of acid. Therefore precautions should be taken to test the acid before dumping to see that it has done its full duty in pickling. If a chemical laboratory is not available, a convenient method of testing has been devised by Wallace G. Imhoff, Vineland, N. J. by which the tests are made with tablets of test chemicals prepared for that purpose.

In making up a new pickle, if the acid content is too low at first, oxides, which sometimes are peened into the surface when tumbling, are not easily attacked and may result in small crater-like defects in the galvanized coat. After the pickle has been used for about 3 days the acid strength should be held at about 90 grams per liter until the last day it is to be used when, if time permits of slow pickling, it may be run down to a strength of about 50 or 60 grams per liter, thereby saving about 2 carboys of acid on a tank of this size.

As some types of castings, like elbows, caps, etc., trap air pockets when lying in a certain position in the pickle basket, it is necessary to provide a perforated cover for the pickle baskets so that they may be lifted from the tank and turned over when pickling is about half completed. Otherwise 10 to 20 per cent of the castings will have spots on the inside which do not coat.

When pickling is found, by inspection of a few castings, to have been completed, the pickle basket is lifted from the tank and rocked back and forth to drain excess acid trapped in fittings. Castings then are dumped upon the hot plate drying table where they are spread out in a layer about 6 or 8 inches thick and allowed to dry. The fittings should dry rapidly but care should be taken to see that none are overheated as the chloride coat left on them at that time will decompose, leaving an iron oxide film which will resist zinc coating.

When properly dried, the castings will have this thin coating of iron chloride ranging in color from greenish black to gray white depending upon the concentration of iron and zinc salts which may be in the pickle. The chloride coatings on the castings assists in the maintenance of a good condition of the flux which must be made to cover the zinc in the kettle before galvanizing is begun and it protects the casting temporarily from rusting. When dry, the castings are raked off onto a shelf adjacent to the drying table where they are handy for subsequent galvanizing.

This is the first of two articles by Mr. Thrasher on galvanizing malleable iron castings. The concluding section will appear in an early issue.

THE EDITORS.

Sand Problems Stressed at Meeting Of French Foundry Association in Paris

ASSOCIATION TECHNIQUE DE FONDERIE held its twelfth annual conference in Paris on Dec. 1 and 2 under the chairmanship of H. Magdelenat, association president.

On that occasion E. V. Ronceray was presented with a bronze bust of himself in commemoration of his recent nomination as officer in the Order of the Legion of Honor. The presentation was made Friday evening, Dec. 1, and in addition to representatives of the government, many outstanding personalities of the French foundry industry were present, together with representatives of foreign foundry technical associations.

Papers were presented during the technical sessions Friday morning, Dec. 1 and Saturday afternoon, Dec. 2. In conjunction with the conference a number of works visits were made in the vicinity of Paris. The annual banquet was held on Saturday, Dec. 2, on which occasion Vincent Delport, European representative of the American Foundrymen's association, repeated the invitation, which he had made at the Prague convention in September, to attend the fifth International Foundry Congress to be held in Philadelphia in October 1934.

The first technical session, which was held under the presidency of H. Luc, general director of the department of technical education, was of outstanding interest. Three of the four papers presented dealt with the subject of foundry sand tests. The first paper was entitled: "Introduction to the Study of Foundry Sands; Properties of Utilization," by L. F. C. Girardet, vice-president of the French association and foundry proprietor at St. Die (Vosges). This paper follows previous investigations made by the author in which he studied the fundamental properties of sands. It deals with constitution, and preparation of sands, and the part played by water. With regard to the properties of utilization, the author describes his researches to find a method of control and the preparation of samples. G. Henon, engineer at the French center of foundry research, spoke on "Some Practical Applications of Sand Tests," and offered founders information which will enable them to appreciate at their proper value the various methods of testing and the different types of testing apparatus for sands.

The next paper, dealing generally with the same subject, was the American exchange paper by H. W. Dietert, president of the Harry Die-

tert Co., of Detroit, on "Methods of Preparation of Sands and Control of Molds", which was read by Vincent Delport, European manager, THE FOUNDRY. The paper describes experiments made on three different sands: Synthetic sand bonded with bentonite; synthetic sand bonded with ordinary clay; regenerated sand coming from old foundry sand. Six different methods of preparation are considered. Certain methods of preparation of green sand improve equally all sands; other methods improve some sands more than others. Methods of preparation have as much influence on natural sands as on synthetic sands. With regard to the variation of the hardness of the mold in function of the method of preparation, an aerated sand never gives the mold, by ramming or by pressure, a hardness as high as that given by a sand that has not been aerated. Furthermore, aerated sand is more sensitive than non-aerated sand to variations in the degree of pressure. The greater the aeration and the size of the grain produced by the method of preparation, the more permeable will be both green sand and dry sand.

The permeability of a mold decreases when the ramming and squeezing pressure increases. The function is along a straight line up to a hardness of the mold of 85; beyond this point the permeability decreases rapidly. For all sands the permeability decreases rapidly when the height of the flask increases. The permeability of a mold varies with the square of the height of the flask.

In the discussion of these papers J. Derdinger, a vice president of the association, stressed the importance of rubbing the grains of sand in the process of preparation and E. V. Ronceray mentioned that this factor has been recognized for quite a long time. M. Girault said that for a sand to be properly rammed, the mold must be rammed first from the top and then from the bottom; in this way the ramming is more regular, and the samples for testing are of practically the same height. Mr. Girardet explained that the methods he had used and described in his paper are not recognized for practical use in the foundry, but are laboratory methods which he has effected to investigate the properties of molding sand. He emphasized the necessity for using very pure water. With regard to Mr. Henon's paper, Mr. Girault said the figure representing the fineness of the sand has no relation to permeability, and he prefers to use the figures giving grain size, as used by the American Foundrymen's association.

M. Prevost presented a paper entitled: "The Manufacture of Sliding Parts in Heavy Machine Tools," in which he enumerated the conditions of control for the founder of large parts subjected to friction in modern heavy machine tools. The author referred to the grade of iron to be used for such parts and the melting of that iron in the cupola. Methods of molding also were discussed from the point of view of obtaining sound castings.

During the second session Saturday, a paper was presented by L. Gasquard on "Ruptures in Castings When Contracting During Solidification." This was followed by the British exchange paper, by Walter West, managing director of the Farington Steel Foundry, Leyland Motors, Ltd., on "Certain Principles on Which Depend the Resistance and the 'Solidity' of Cast Iron." The author discussed: (a) refined cast irons and their true characteristics; (b) the limits of control of the carbon; (c) phosphorus and its influence. The paper gives a general summary of the practical researches now being effected.

R. Berger presented the Belgian exchange paper, prepared by a special committee of the Belgian technical association, on "The Study of the Castability of Cast Irons," a subject which has been under investigation by this special committee for a number of months and in regard to which investigations still are being pursued.

A. Debar, professor at the Ecole Superieure de Fonderie, contributed a paper entitled: "The Standardization of Flasks." Ing. Aurelio Aureli presented an exchange paper on behalf of the Italian founders entitled: "Centrifugal Force Applied to the Industrial Manufacture of Cast Iron Pipe," in which the author reviews the various methods now being used in the manufacture of cast iron pipes by the centrifugal process.

A. S. T. M. Approves Tentative Standards

Tentative standards recently have been approved by the American Society for Testing Materials, including tentative specifications for carbon-steel castings for industrial railroad and marine uses (A 154-33T); tentative specifications for magnesium ingot and stick for remelting (B 92-33T); and tentative methods of impact testing of metallic materials (E 23-33T). Revisions in existing tentative standards have been made for methods of sampling coke for analysis (D 346-33T); rockwell hardness testing of metallic materials (E 18-33T); and chemical analysis of aluminum and light aluminum alloys (B 40-33T). Tentative revisions of standard specifications have been made for aluminum-base alloy sand castings (B 26-31); aluminum base sand casting alloys in ingot form (B 58-31); and for the standard method of chemical analysis of brass ingots and sand castings (B 45-27).

Stresses Progress In Castings Manufacture

Advancement in foundry practice was reflected in remarks by Maj. R. A. Bull, consulting engineer, Chicago, before a joint meeting of the New Jersey Foundrymen's association and the New Jersey chapter of the American Society for Steel Treating in Newark, N. J., Dec. 11. Gray iron, he said, is fast catching up with progress in steel and malleable and the foundry industry as a whole is offering increasing resistance to inroads of forgings and weldings.

The speaker discussed the influence of design on the physical properties of castings, spoke of problems peculiar to the principal ferrous grades and dwelt to some extent on the use of alloys. He illustrated his remarks with lantern slides.

Also of interest to more than 80 who attended the meeting, was the outline of the organization of the American foundry industry for technical research and progress, by John L. Carter, secretary of the New Jersey Foundrymen's association. Mr. Carter fixed the beginning of this organization on a national plane with the establishment of THE FOUNDRY in 1892, approximately 42 years ago. He then referred to the organization of American Foundrymen's association in 1896, tracing subsequent major organization activities down to the present time, with the formation of the nonferrous foundrymen into an association possibly the most notable recent development.

Heat Treatment of Iron Features Meeting

Oliver Smalley, president, Meehanite Metals Corp., Pittsburgh, addressed the regular meeting of the Philadelphia Foundrymen's association held Dec. 13 at the Manufacturers and Bankers club, on "Heat Treatment of Cast Iron." His interesting and instructive talk was illustrated with lantern slides and blackboard diagrams.

Special invitations to attend the meeting were extended to the Philadelphia members of the American Society for Testing Materials, the American Society for Steel Treating, the American Society of Mechanical Engineers and the Metal Manufacturers Association of Philadelphia.

The department of commerce, bureau of mines, recently has published "Iron Ore, Pig Iron, Ferroalloys and Steel," by O. E. Kiessling and H. W. Davis. The bulletin represents a chapter from the *Minerals Yearbook*, and may be obtained through the superintendent of documents, Washington, for 5 cents.

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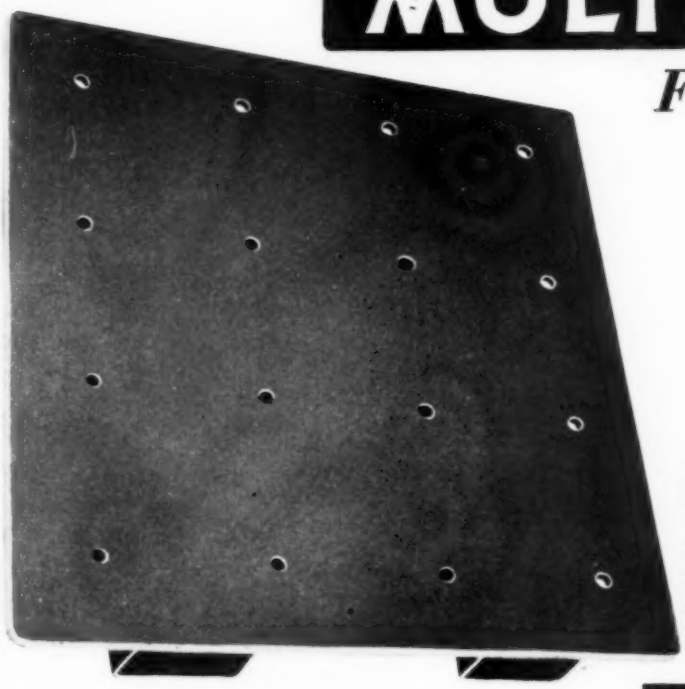

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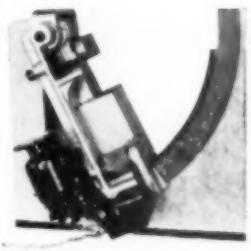

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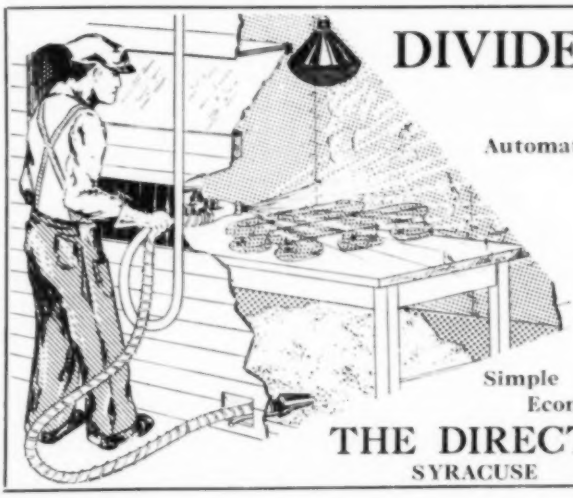

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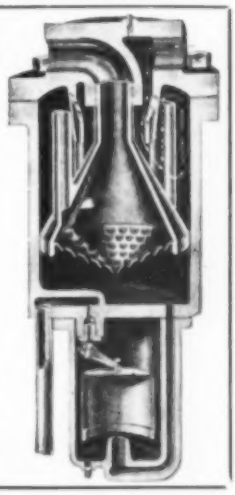

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Needs Flexibility of Operation

(*Concluded from Page* 21)

1930, 17 cents per pound in 1931, 15.75 cents per pound in 1932 and then has continued to drop since the sales price of castings has continued downward whereas the price of virgin metals has turned upward. Today the apparent spread between raw metal costs and sales price of nonferrous castings is 7.25 cents per pound. From this it is quite evident that the competitive selling practices within the industry have reached a point where something drastic in the way of regulation is necessary to avoid complete extinction of the industry. It is the hope of the members of the Nonferrous Foundry association that the successful operation of the code will accomplish this desired result.

A study of weekly hours worked by various members of the industry has been made from the reports received. In 1928 approximately 97 per cent of the industry operated over 40 hours per week. In 1929, it was similar. In 1930, 95 per cent, in 1931, 84 per cent, in 1932, 67 per cent were operating on a schedule of over 40 hours per week and this continues through to the present time. The percentage of the industry operating a schedule of 40 to 45 hours per week has increased as the percentage operating on a higher work week has decreased. The percentage operating over 50 hours per week in 1928 was 39 per cent and this has fallen gradually until only 6 per cent of the industry is operating over 50 hours per week, while 11 per cent is operating 45 to 50 hours per week.

Have Spread Work

Again it is quite evident that the industry has been spreading work by decreasing the total hours of work per week. In accordance with the code as submitted it is proposed to follow this practice further and establish in the industry a normal 40 hour week.

It has also been possible to arrive at certain average figures with regard to minimum wages paid by the industry during the past years in the various districts in the country according to the geographical districts laid out by the association. From reports received from almost 400 different concerns in the industry from all parts of the country, it has been found that the minimum wages paid in the Northern districts varied from 18 to 30 cents per hour in 1928, 1929 and 1930, from 16½ to 30 cents per hour in 1931, from 16 to 25 cents per hour in 1932, and from 16 to 27 cents per hour during the first portion of 1933. The minimum wage scale in District No. 8 which is the South is indicated to have been 12 cents per hour in 1928, 1929, and 1930 and 10 cents per hour since.

The average minimum wage in cents per hour paid throughout the entire industry was 24½ cents in 1928 and 1929, and this gradually dropped off to 20 cents in 1932 and the first portion of 1933. Raising the minimum from these figures to the figure as set in the proposed code for the industry will represent an increase in minimum wages of almost 100 per cent. Attention is called to the fact that the industry believes that a minimum wage of 35 cents per hour is justified by the actual figures of the industry and this minimum wage figure of 35 cents per hour is that which the code as originally drawn up for this industry specified. It is certain that no higher figure than 40 cents per hour could be set and still allow the industry to continue in operation, and there is considerable question on the part of many members of the industry whether they can continue in business at any rate higher than the 35 cents rate agreed to previously.

The nonferrous foundry industry produces castings entirely on orders from its customers and, therefore, cannot produce in advance and carry an inventory in anticipation of demand. It must be ready to produce castings when, as and if its customers demand them, and, therefore, it must be in a position to quickly increase or decrease its production as the requirements of its customers demand. This necessitates a certain flexibility in the hours of work for it is practically impossible to provide additional pattern equipment during a rush and have it finished in time for production requirements. However, it is desirable, to work only during the daylight hours, and, therefore, during the rush season it must be permissible to increase the work week. This has been the practice rather than to increase the hours per day. Often it is necessary to increase the work week as specified in the code due to the fact that the production required by customers from given pattern equipment cannot be obtained in the fewer hours.

In many cases, the pattern equipment is such that only particular employes with experience in handling the particular pattern equipment in question economically can produce castings from it and, therefore, it is not possible to bring in new men to work the excess hours on this particular pattern equipment and still meet production schedules. New men entirely unacquainted with the pattern equipment could not possibly reach normal production during the period of a rush order.

The industry, as stated in the code, recognizes the principle of the eight-hour day, but calls attention to the fact that the nature of the operations within the industry are such that they cannot be started and stopped by the blowing of a whistle.

Encounter Variables

In this industry metal is melted in small batches, often crucible, and the time required for melting a batch is subject to many unavoidable and unexpected variations. The rate of melting is affected by the humidity of the atmosphere, the initial temperature of the furnace, the nature of the alloy being melted, the age of the refractory in the furnace or in the crucible, and in the case of natural draft furnaces upon the outdoor weather conditions. The melting schedule is not only subject to these uncontrollable and unpredictable variations, but also subject to variations due to breakdown of production equipment.

A majority of the nonferrous castings are poured into green sand molds. Frequently the surfaces of these molds are dried by a torch just previous to closing and preparation for pouring. When a mold is so completed and closed, it is necessary that the metal be poured into it at once. It is not possible to leave this mold stand overnight and pour metal into it the following morning. As a result of this, it is necessary, if some delay has occurred in the melting process, to work overtime sufficiently to melt and pour the necessary metal. In other words, the day's work is done when the

(*Concluded on Page* 54)

Collects Data

FOLLOWING the organization meeting of nonferrous foundry operators during the Chicago convention of the A. F. A., and the subsequent formation of the Nonferrous Foundry Association for Industrial Recovery, work of collecting employment and production statistics within that industry was undertaken. This article is from a summation of those statistics, as presented at the public hearing on the code of fair competition of the nonferrous industry at Washington on Oct. 27. The code for the industry was approved and signed by the President on Dec. 18, and now is in effect.

Mr. Tour is secretary of the Nonferrous foundry association for Industrial Recovery with headquarters at 47 Fulton street, New York.

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*6

molds made have had the metal poured in them and this may be at the end of a 7-hour period or at the end of a 9-hour period and cannot be made to come exactly at the end of a fixed 8-hour period.

Nonferrous castings are in many cases in competition with forgings, pressed steel parts, welded products, malleable, gray iron and steel castings, stampings, die castings, and composition molded products and these various things are encroaching upon the market for nonferrous castings. To further reduce the permissible maximum hours of work or to further increase the minimum rates of pay required for employes in the nonferrous foundry industry would give these competitive products an undue advantage and would, therefore, operate to the detriment of the entire industry.

Organization of Gray Iron Foundries

A meeting of the directors of the Gray Iron Founders society was held in Cleveland Thursday, Jan. 11, at which time organization was perfected to administer the code of the gray iron industry. In accordance with the code six members of the society were designated, who with two representatives from nonmembers in the industry will compose the code authority.

The new directors of the Gray Iron Founders society are as follows: Ronald Kucher, Olympic Foundry Co., Seattle; A. J. Muhlbach, Vernon Foundry Co., Hollydale, Calif., District No. 1, Washington, Oregon, Idaho, Montana, California, Utah, Arizona, Nevada.

A. C. Ziebell, Universal Foundry Co., Oshkosh, Wis., District No. 2, Minnesota, North Dakota, South Dakota, Wyoming, Wisconsin, Nebraska.

Kenneth L. Green, Green Foundry Co., St. Louis, District No. 3, Colorado, New Mexico, Kansas, Missouri.

C. B. Magrath, North Western Foundry Co., Chicago; R. D. Phelps, Francis & Nygren Foundry Co., Chicago, District No. 4, Iowa, Northern Illinois, Northern Indiana.

George Branston, Campbell, Wyant & Cannon Corp., Muskegon, Mich., District No. 5, Michigan.

Walter L. Seelbach, Forest City Foundries Co., Cleveland, District No. 6, Northern Ohio.

A. H. Kramer, Advance Foundry Co., Dayton, O., District No. 7, Southern Indiana, Southern Ohio, Kentucky.

W. H. Winters, general superintendent foundries, American Brake Shoe & Foundry Co., Pittsburgh, District No. 8, Western Pennsylvania, West Virginia and Garrett and Allegheny Counties of Maryland.

N. H. Schwenk, Cramp Brass & Iron Foundries Co., Paschall Station, Philadelphia, District No. 9, Eastern Pennsylvania, Southern Jersey, Delaware, District of Columbia, Maryland (except Garrett and Allegheny Counties).

Robert E. Dillon, Lake Erie Engineering Corp., Buffalo, District No. 10, Western New York—Erie County, Pa.

A. B. Root, Hunt-Spiller Mfg. Co., Boston, District No. 11, Massachusetts, Rhode Island, Maine, New Hampshire, Vermont.

Franklin R. Hoadley, Farrell-Birmingham Mfg. Co. Inc., Ansonia, Conn., District No. 12, Connecticut, Eastern New York.

Walter H. Cole, Moore Bros. Co., Elizabeth, N. J., District No. 13, Northern New Jersey, Section of Northeastern Pennsylvania.

Arthur E. Hartwell, Hartwell Iron Works, Houston, Tex., District No. 14, Texas, Oklahoma, Arkansas, Louisiana.

W. A. Rigsby, Lombard Iron Works & Supply Co., Augusta, Ga., District No. 15, Mississippi, Alabama, Tennessee, Georgia, Florida, North Carolina, South Carolina, Virginia.

The directors mentioned were nominated by a committee composed of H. S. Washburn, Plainville Castings Co., Plainville, Conn.; William J. Grede, Liberty Foundry Inc., Wauwatosa, Wis.; A. W. Lemme, Elizabeth Street Foundry Co., Chicago; W. A. Rigsby, Lombard Iron Works & Supply Co., Augusta, Ga., and S. H. Standish, G.H.R. Foundry Co., Dayton, O.

Outline Plans For District Chapters

The board of directors of the Nonferrous Foundry Association for Industrial Recovery met in Cleveland Jan. 6 and 7 and outlined the functions of local chapters for operation under the industry code approved Dec. 18, 1933. Membership in chapters will be confined to those affiliated with the association. The groups will assist the code authority of the industry in settlement of complaints, will collect dues and statistics, co-operate on merchandising policies and will work with local groups of associations under other codes. The chapters will hold meetings periodically, at least six times during the year.

Under the nonferrous code, the administrative agency will be made up of the president, vice president, executice secretary and a member from each of the groups operating under supplementary codes to the basic nonferrous code. At present these groups number four, covering sand castings, aluminum permanent mold castings, steel and rolling mill castings and blast furnace castings.

Consideration was given to selecting these representatives by the various groups. A cost committee was appointed consisting of Sam Tour, chairman, A. Lockwood and N. K. B. Patch, Lumen Bearing Co., Buffalo; J. L. Wick, Falcon Bronze Co., Youngstown, O. and Allen B. Norton, Aluminum Co. of America, Cleveland.

Members present at the meeting included N. K. B. Patch, president; Allen B. Norton, vice president; Sam Tour, executive secretary and the following directors: Frank Hayes, Chicago Hardware Foundry Co., N. Chicago; D. D. Francis, National Bronze & Aluminum Foundry Co., Cleveland; H. A. White, National Bearing Metal Co., Pittsburgh; James L. Wick; Charles Wegelin, Dixie Bronze Co., Birmingham, Ala.; George B. Miller, Loeffelholz Co., Milwaukee; A. J. Peterson, Advance Pattern & Foundry Co., Chicago; T. S. Hemenway, Metal & Alloy Specialties Co., Buffalo; J. A. Duncan, Wm. Duncan & Co., East Boston; Harry W. Holt, Bohn Aluminum & Brass Co., Detroit; E. G. Fahlman, Permold Co., Cleveland and W. Heckman, National Art Bronze Works, St. Louis.

Castings Shown at Ford Show in New York

High standards of foundry practice were reflected at the exhibition of the Ford Motor Co. in New York, Dec. 9-29. Approximately 3,000,000 visited the show, which depicted the 30 years of progress of the company.

Included in the larger foundry displays was that of the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. Exhibits showed various stages in the production of the Ford V-8 cylinder block; also cores, 48 pieces in all, making the complete set. Motion pictures illustrated actual work of production in the Muskegon foundry.

The Detroit Steel Castings Co., Detroit, had an interesting display of tools made from heat-treated steel castings produced in its foundry. The company also showed alloy steel pots such as supplied the Ford Motor Co. for cyaniding automobile parts and a series of exhibits dealing with the microstructure and test qualities of steel castings.

Michigan Malleable Iron Co., Detroit, displayed strength and ductility test bars and castings used in differential housings and other parts of Ford motor. The City Pattern Works, Detroit, had an effective display of brass and aluminum castings, along with complete pattern equipment and cores for producing the Ford cylinder block. The die casting division of the Cleveland Hardware & Forging Co. exhibited intricate die castings.

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Therm-O-Flake Insulation

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Progress in Malleable

Recent Metallurgical Developments in the American Malleable Industry, by J. H. Hruska, exchange paper of A. F. A. presented at foundry congress in Prague.

The paper summarizes recent metallurgical progress in the production of black-heart malleable iron. First, the tendencies in the malleable industry to shorten the thermal cycles are discussed from the viewpoint of contemporary metallurgical research. So-called high-strength malleable is then compared with standard malleable. Subsequently, the results of various experiments with alloying normal malleable are scrutinized. The following chapters deal with the most modern principles and methods in producing malleable of outstanding physical properties by specific thermal processes developing residual or secondary cementite in the matrix. Two principal methods are described, and actual examples for both processes are given.

Graphite Flakes

Relations Between the Mechanical Properties and the Structure of Cast Iron (Relations Entre les Proprietes Mecaniques et la Structure de la Fonte), by Dr. Ing. Gustav Meyersberg. *Bulletin* of the Association Technique de Fonderie, Paris, September, 1933.

For cast iron the tensile test is not adequate to give results in which elongation plays a considerable part. The transverse test is more advantageous in that respect if the test piece has sufficiently large dimensions. It is easier in these cases to measure the deflection than the elongation.

The author also states that it is possible to obtain a numerical characteristic of the shape of the graphite flakes, which can be looked upon as an adjunct or a substitute for the microscopic examination. He points out that if, on the one hand, graphite prejudices the strength of the steel matrix, it should not be considered only as an injurious factor. Cast iron is less sensitive to exterior deterioration than steel, and the high content of carbon which is found in cast iron reduces its melting point and, therefore, gives it satisfactory castability. Graphite also has a favorable part in reducing wear by friction of sliding surfaces. Briefly, graphite confers upon the material a number of specific advantages.

Study Shrinkage

Study of Shrinkage (Etude due Retrait), by the scientific committee of the Association Technique de Fonderie de Belgique. Rapporteur: Rene Berger. *La Fonderie Belge*, September, 1933.

The committee proposes to study and classify the more interesting papers and articles that have been published on the question of shrinkage. In this introductory article, a number of definitions are given, and the factors governing the shrinkage of metals in molds are reviewed. The various methods employed to permit of free contraction of the metal in the mold are listed.

Many cases occur where the metal is not able to contract freely in the mold, and this creates internal stresses. A simple theory of internal stresses is given and illustrated by examples taken from pulleys, plates, and various bar sections. In each case an explanation is given of the manner in which the internal stresses have occurred and of the deformations which result in the solid castings.

Another effect of shrinkage is the formation of piping in ingot heads and in the more massive parts of various castings. A simple theoretical study of this phenomenon is given, first by considering a solidified metal sphere, followed by the consideration of the solidification of an ingot. Mention is also made of the use of coils and spirals and, in the more difficult cases, of the method of *pumping* with a red-hot rod which is moved up and down in the head. Further considerations are given concerning the factors inherent in the metal, such as changes in the specific volume at the time of solidification and during periods of allotropic transformations.

Powdered Coal Melting

Mechanical Properties of Low-Carbon Cast-Iron (Proprietes Mecaniques des Fontes a Basse Teneur en Carbone), by George Delbart. *La Fonte*, bulletin of the French center of foundry research, Paris, April-May-June, 1933.

The author has investigated the mechanical properties of cast-iron melted in the cupola and in which the carbon contained ranged from 1.7 to 3.4 per cent and the manganese from 0.40 to 4.70 per cent.

Object of the present investigations was mainly to see how far the mechanical properties would improve by a reduction in the carbon content, and also to increase the knowledge of the influence of manganese.

Dealing more especially with the mechanical properties, these depend primarily upon the following factors: (a) aptitude for primary quenching, with formation of cementite; (b) aptitude for secondary quenching, with formation of martensite; (c) structural heterogeneity; (d) susceptibility to piping and inter-crystalline cracks. Aptitude for primary quenching in ordinary cast-irons depends principally upon contents of silicon and total carbon. Action of manganese is somewhat difficult to appreciate in current irons.

Susceptibility to piping varies mainly with the carbon content, and is particularly noticeable as soon as the total carbon becomes less than 2.30 per cent. A number of authors attribute to manganese an influence toward the formation of inter-crystalline cracks, and the majority of foundries seem to refrain from exceeding 1 per cent manganese.

Generally speaking, there is a sudden variation in the mechanical properties for a total carbon content of from 2.50 to 2.70 per cent. It is pointed out that the best tensile strength tests were obtained with irons having the following average chemical composition: Total carbon, 2.2 to 2.4 per cent; silicon, 3 per cent; manganese, 0.50 per cent; sulphur, less than 0.09 per cent; phosphorus, less than 0.120 per cent.

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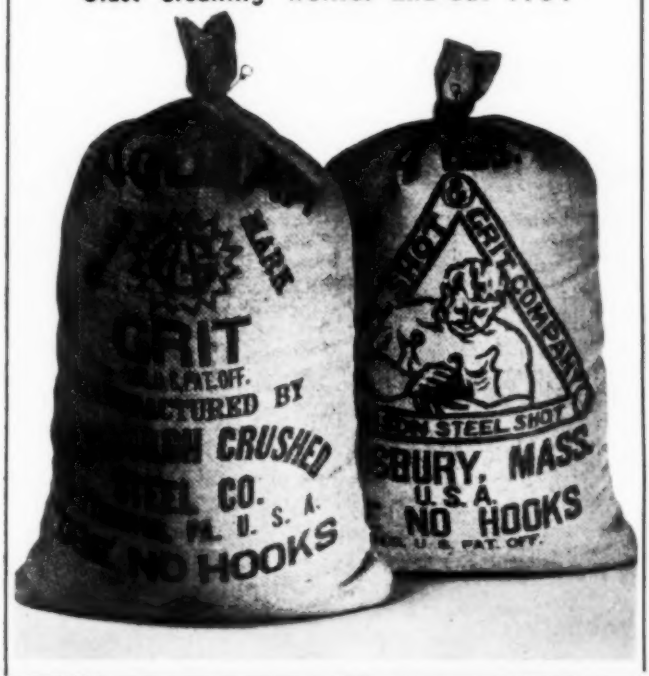

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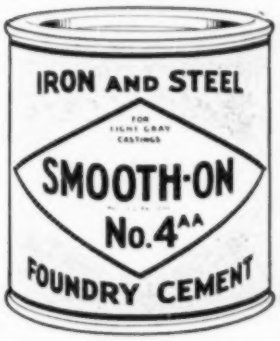
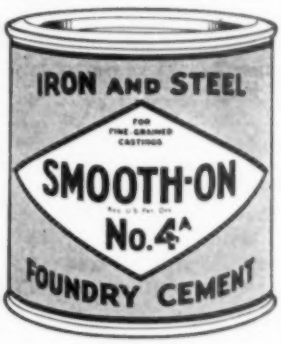


Smooth-On No. 4AA

For light gray castings and machined surfaces. Has high metallic lustre. Takes fine machine finish.



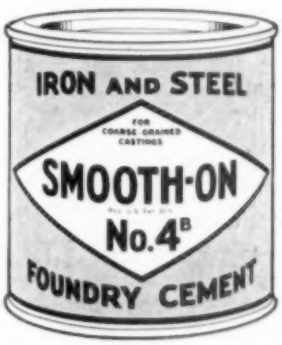
Smooth-On No. 4A

For medium gray castings. A fine grained cement that has a good metallic lustre.

THREE *entirely new* Smooth-On compositions, each with its own distinct color, degree of lustre and fineness of grain, are now available to the foundryman for filling surface blemishes, pits, porous spots, etc., in iron and steel castings of any shade, appearance and quality.

With these three new Smooth-On Cements you can match the shade and lustre of any casting.

This achievement makes the surface corrections undetectable, and adds significant efficiency to Smooth-On treatment.



Smooth-On No. 4B

For dark gray castings. A cement of coarser grain and darker shade.

Smooth-On No. 4 AA, Smooth-On No. 4 A and Smooth-On No. 4 B are decidedly the best for foundry requirements.

Castings judiciously treated with Smooth-On look better and are worth more. *Take advantage of this new Smooth-On development.* Mail the coupon for free hardened and working samples, and give the latter a fair test on your own product.

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Obituary

JOSEPH L. TILLMAN Sr., 67, president, Industrial Steel Casting Co., Toledo, O., and for many years a leader in the industrial and civic affairs of that city, died Jan. 1. Mr. Tillman was born in Toledo, March 25, 1866. His first position was with the Merchants Dispatch & Transportation Co., where he remained for a brief period. He then became connected with the Bostwick-Braum Co., and in a period of 30 years with that company won promotion through the various departments. Later he resigned to become president of the Maumee Malleable Casting Co. and the Industrial Steel Casting Co. He sold his interest and retired from the malleable company in 1926. Mr. Tillman also had interests in numerous business enterprises and was president of the Wine Railway Appliance Co. Four sons, Ralph, Lambert, Joseph L. Jr., and Raymond L. were associated with their father in the Industrial Steel Casting Co.

Thomas Finigan, 51, executive vice president, American Brake Shoe & Foundry Co., died at Chicago recently.

Arthur H. Springer, 74, president, Spring-Whitaker Foundry Co., Terre Haute, Ind., died recently at his southern home in Winter Haven, Fla.

George W. Koehler, 73, for many years proprietor of the Koehler Brass Foundry, Cedar Rapids, Iowa, died at his home on Dec. 4.

Arthur A. Brown, 60, assistant to the vice president, Westinghouse Electric & Mfg. Co., Pittsburgh, died at his home in Mt. Vernon, New York, recently.

Herbert Thacker Herr, 57, vice president of the Westinghouse Electric & Mfg. Co., Pittsburgh, and a noted engineer, died recently at his home in Philadelphia.

Fred Thoma, one of the founders of the East Hamilton Foundry, Hamilton, O., died recently at his home. Mr. Thoma had served as vice president of that company for many years.

John A. Findlater, manager, pattern department, Buick Motor Car Co., Flint, Mich., died recently at his home. Mr. Findlater had been in the employ of the Buick company for 20 years.

John McKenzie, who recently was appointed efficiency engineer for the Dortch Stove works, Franklin, Tenn., was injured in an automobile accident near Knoxville, Dec. 21 and died Dec. 31.

William J. Myers, 79, former president of the Union Stove Works, 70 Beekman street, New York, died Dec. 9, at his home in Brooklyn. Mr. Myers had been connected with the Union Stove Works for 52 years until his retirement 4 years ago. He is the former president of the National Association of Stove Manufacturers.

John J. Mahoney, 77, Cahill Iron Works, Chattanooga, Tenn., died recently in that city. He was one of the organizers of the Lookout Boiler Co. and the Southex Machine Co. of Chattanooga.

Thomas H. Wiles, 62, foundry superintendent, National Malleable & Steel Castings Co., Indianapolis, died recently in that city. Mr. Wiles had been connected with the National company since 1891.

Otto Ricker, 62, superintendent, Badger Malleable & Mfg. Co., South Milwaukee, Wis., since its organization, died at Milwaukee Dec. 6. His brother, Adolph J. Ricker, is president of the company.

William C. Letchworth, 77, former general manager, Acme Steel & Malleable Iron Works, Buffalo, died recently at his home. Mr. Letchworth retired in 1923 and since that time has devoted himself to world travel.

Archibald Alston Stevenson, 71, one of the pioneering leaders of the iron and steel industry, formerly vice president of the Standard Steel Works and a past president of the American Society for Testing Materials, died at his home in Ardmore, Pa., Dec. 15.

Stanhope Boal, 77, president, Favorite Stove & Range Co., Piqua, O., died Dec. 17 at his home. The company, founded by his father, the late W. K. Boal, in Cincinnati, was removed to Piqua 43 years ago. Mr. Boal served as president of the National Association of Stove Manufacturers and the Western Association of Gas Range Manufacturers.

D. J. Murray, 89, founder and president until a few years ago of the D. J. Murray Manufacturing Co., Wausau, Wis., died Dec. 14 at his home. Mr. Murray was born in Scotland and went to Wisconsin in 1876. For several years he was connected with a foundry in Menominee, Mich., before starting the plant in Wausau. He retired from active business 10 years ago.

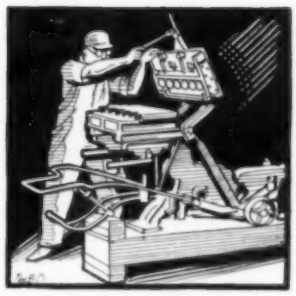
Stewart Johnston, founder and chairman of Pittsburgh Steel Foundry Corp., Glassport, Pa., died at Pittsburgh, Dec. 30. He was born in Pittsburgh in 1865 and after graduating from Rensselaer Polytechnic institute, Troy, N. Y., began his career with Pittsburgh Steel Casting Co. as a draftsman. A year later he became assistant superintendent of the company, then superintendent in 1889 when the company was absorbed by the American Steel Casting Co. After the merger, Mr. Johnston was chosen president of the Pittsburgh Steel Casting Co. division but in 1898 he organized the Pittsburgh Steel Foundry Co. and was made its first president, remaining in that position until April of 1925 when he was elected chairman of the board in the reorganization of the company into a corporation. Mr. Johnston was a member of many Pittsburgh clubs and a trustee of Rensselaer Polytechnic institute.

Isaac Bradley Johnson, 76, vice president and treasurer of the old Isaac G. Johnson Co., manufacturer of steel castings, Spuyten Duyvil, New York, died Dec. 14 at the Presbyterian hospital, New York, after a long illness. Mr. Johnson was born in Spuyten-Duyvil and lived there most of his life. He was graduated from the School of Mines, Columbia university, in 1879 and in 1883 entered the business founded by his father, the late Isaac G. Johnson. Several years ago he was chosen vice president and in May, 1932, was elected treasurer to fill the vacancy left by the death of a brother, Gilbert H. Johnson.

Clifford F. Messinger, 44, president, Chain Belt Co., Milwaukee, died at his home Dec. 13. Mr. Messinger was born in New Haven, Conn. and following his graduation from Sheffield scientific school at Yale university in 1911, joined the Chain Belt organization as an apprentice. He was successively advertising manager, sales manager, assistant to the president, vice president, and since December, 1930, president, having succeeded his brother, C. Raymond Messinger, when the latter became president of the Oliver Farm Equipment Co. Mr. Messinger also was a director of the Interstate Drop Forge Co., Sivyer Steel Casting Co. and the Federal Malleable Co., of Milwaukee.

George Krouse, 77, successful and widely known brass foundryman of Jersey City, N. J., died Dec. 6 at his home. He was born in Suffern, N. Y. on June 9, 1856. As a boy on the farm his mind seemed to turn instinctively to the creating of things in metal, and so, during his early youth he worked on the farm in summer and for 2 winters was employed as an apprentice at the Blauvelt Plow Works, Suffern. This was followed by 3 years in the shops of the Ramapo Car Wheel & Foundry Co., Ramapo, N. Y., in the capacity of molder. After leaving that company Mr. Krouse was employed for a period in Dayton, O. In 1887 he started his own foundry business at 150 Morgan street, Jersey, City, and in 1896 he moved to Passaic, N. J., where he was living at the time of his death. He was an interested and loyal member of the American Foundrymen's association, the Newark Foundrymen's association now the New Jersey Foundrymen's association, and the Metropolitan Foundrymen's association. He was also a director of the Commercial Trust Co. of Jersey City and a member of the Downtown Lunch club, Jersey City.

New Equipment



For Foundries

Locks Sliding Switch in Position

A new tramrail sliding switch, which it is claimed minimizes the necessity for superstructure, recently has been introduced by the Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland. The unit is so designed that the curved section and the straight section, shown in the accompanying illustration, are welded to the sliding plate which moves to either position of the switch on four rollers mounted on the switch frame.

A latch at either end on the upper side of the sliding plate keeps the switch locked in position. To throw the switch, the chain attached to the locked latch is pulled to release the latch and to roll the switch into the other position. The second latch locks the switch.

Coupling Acts As Automatic Starter

Falk Corp., Milwaukee, has introduced a new coupling designed to start, couple, cushion and limit the load. The primary function of the coupling is its use as a centrifugally operated automatic starter. The construction involves two drum-shaped members, one attached to the driving shaft and the other to the driven shaft. Between driving and driven members are inserted two sets of floating segments, made usually of brake lining reinforced with lead. The amount of lead is calculated to give the required centrifugal pressure for carrying the load.

Cleaning Machine Operates Automatically

Homestead Valve Mfg. Co., Coraopolis, Pa., recently has added a new, automatic model to its line of machines for all purpose cleaning, paint-stripping, or sterlizing. The new machine follows the earlier models in that it generates a vapor blast and combines in any desired proportion the basic requisites for cleaning.

The new model is driven by an electric motor operating on a lighting circuit. The fuel-oil burner used for heat generation is of the pressure atomizing type. Rotary water and fuel oil pumps, direct-connected to the ¼ horsepower motor, are employed.

A saturation selector permits the operator to obtain any degree of vapor saturation from a heavy, cutting spray for removing heavy deposits of dirt, grease or other foreign matter, to a light, misty spray for cleaning painted surfaces, etc. The nozzle control gives the operator full control of the machine functions while working, and permits the continuous automatic operation of the machine. The motor, generator pumps, and fire start when the vapor outlet valve is opened, and stop immediately when it is closed; whether the valve is at the machine, or on a cleaning gun at the end of several hundred feet of hose.

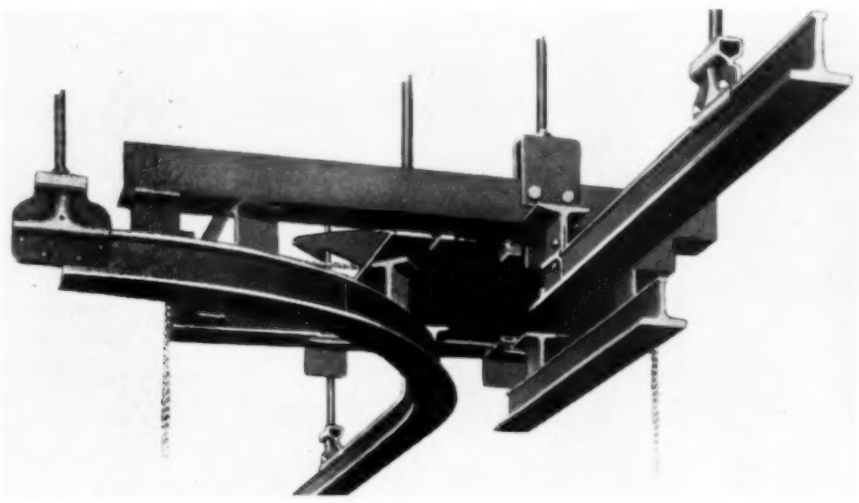
Starting Switch Is Made in Three Types

A solenoid-operated, across the line starting switch recently has been introduced by the Allen-Bradley Co., 1311 South First stret, Milwaukee. The unit is rated at 5 horsepower, 220 volts and 7½ horsepower, 440-550 volts for polyphase motors, and up to 1½ horsepower, 110 volts, 3 horsepower, 220 volts for single phase self-starting motors. The unit is made in 3 forms: Form 1, with start and stop push buttons; form 2, without push buttons, for thermostat or remote pilot control; form 3, with 2-way hand-automatic switch for try-out control installations. Relays with interchangeable thermal elements provide overload protection.

High Speed Pumps May Be Direct Connected

A line of double-suction, split-case pumps, especially designed for operation at high speed, has been developed by the Morris Machine Works, Baldwinsville, N. Y. The pumps may be direct connected to electric motors or steam turbines operating at 3500 revolutions per minute, and they also may be belt-driven or operated through gears by low-speed drivers, such as gasoline engines.

The impeller has been designed and finished to minimize friction and eddy losses. Deep groove, heavy-duty precision ball bearings are used on each side of the pump to take care of both radial and thrust loads. The pumps are built in sizes from 1½ inches to 5 inches.



The curved and straight sections are welded to the sliding plate which moves to either position of the switch

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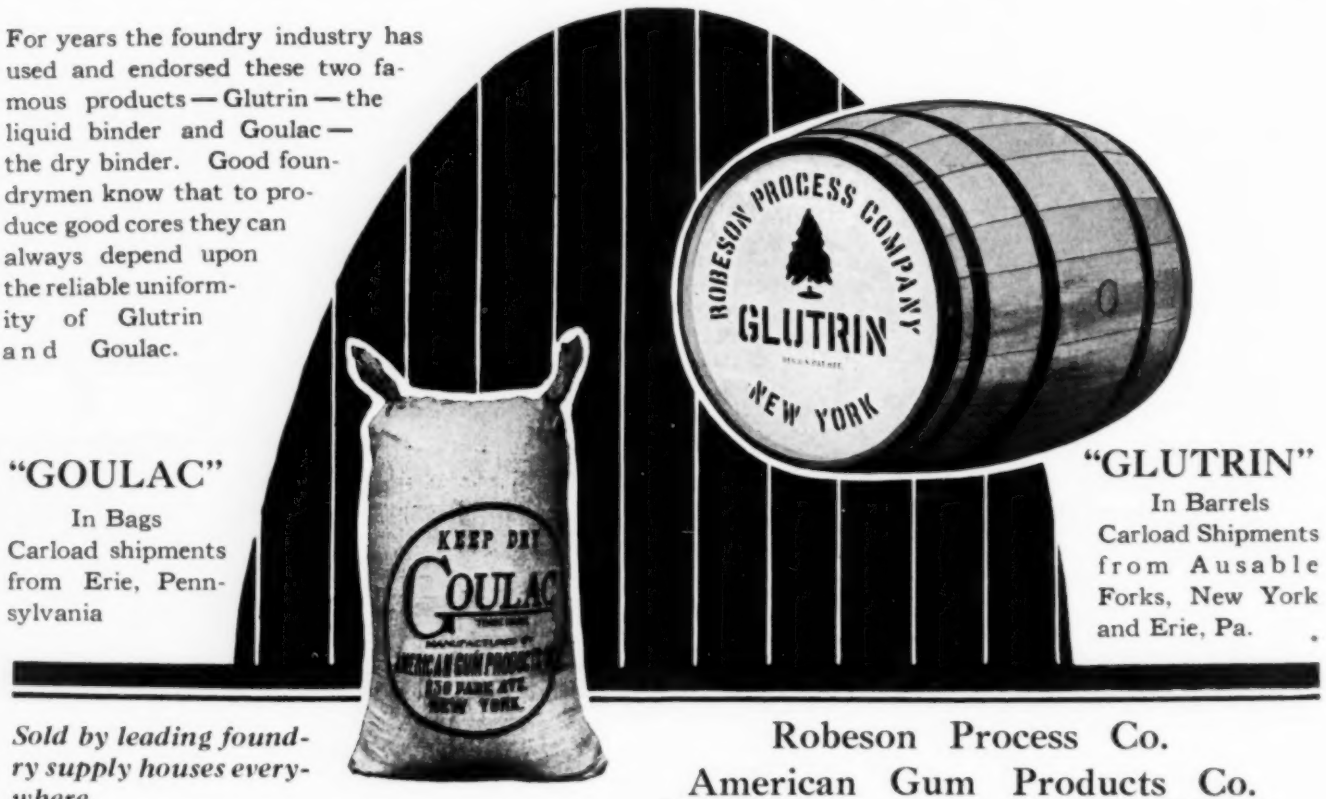
For years the foundry industry has used and endorsed these two famous products — Glutrin — the liquid binder and Goulac — the dry binder. Good foundrymen know that to produce good cores they can always depend upon the reliable uniformity of Glutrin and Goulac.



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"GLUTRIN"
In Barrels
Carload Shipments from Ausable Forks, New York and Erie, Pa.

Sold by leading foundry supply houses everywhere.

Robeson Process Co.
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230 Park Ave. New York

The GRIFFIN Hot-Blast Process for CUPOLAS

THE Griffin Hot-Blast Process reduces coke consumption more than 25 per cent, permits the safe use of more scrap in the charges, improves the melting and pouring practice at every stage from start to finish, promotes safety, assures greater uniformity and better quality of the finished castings and greatly reduces rejection losses.

TO the thermal and net money benefits of cupola hot-blast and high heat recovery from cupola gases, the Griffin Process further adds the distinct advantage of continuous cupola flow into teapot-spout reservoir and mixing ladle, and transfer to the moulds in bottom-pouring ladles, for triple elimination of slag and maximum efficiency of sulphur control.

All installations to date have shown a net return of at least 50 per cent on the investment.

Write for revised Bulletin No. 532

THE AIR PREHEATER CORPORATION
Under management of The Superheater Company
60 E. 42nd St., New York

Works: Wellsville, N. Y.; *Agents in*

Boston	Philadelphia	Pittsburgh	Washington	San Francisco
Buffalo	Cleveland	Cincinnati	Ft. Worth	Tacoma
Chicago	St. Paul	Indianapolis	Houston	Portland
Charlotte	St. Louis	Kansas City	Denver	Seattle
Detroit	New Orleans	Salt Lake City	Los Angeles	Spokane

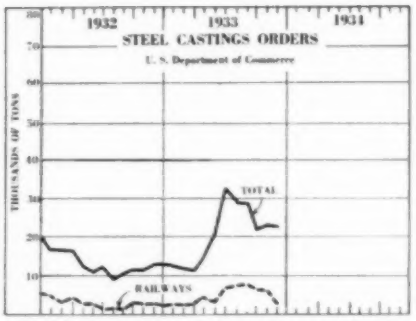
HANNA PIG IRON

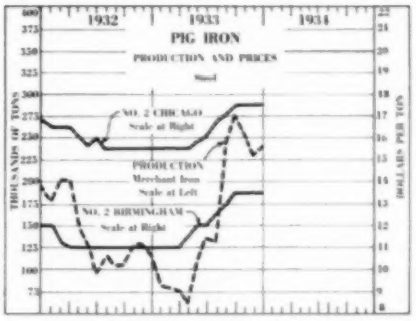
—dependable uniformity

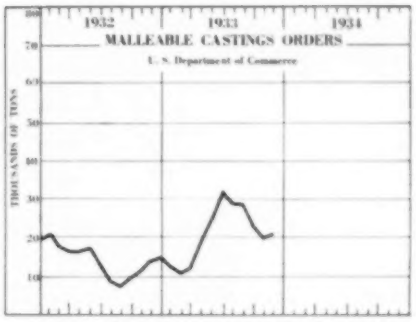
BRANDS:
Buffalo—Detroit—Susquehanna

GRADES:
Foundry—Malleable
Silvery — Ferro-Silicon

The HANNA FURNACE CORP.
MERCHANT PIG IRON DIVISION
OF NATIONAL STEEL CORP.
Buffalo New York
New York Philadelphia Detroit, Mich.
Boston







Foundry Activities

Reflect Industrial Trends

McFARLAND FOUNDRY & MACHINE CO., Willow and Miller streets, Trenton, N. J. recently has changed its name to the Trenite Corp. The company specializes in alloy castings for heat, abrasion and corrosion resistance.

* * *

Slack-Horner Brass Mfg. Co., Denver, Colo., has moved from 1638 Blake street to 1130 12th street.

* * *

Newton Brass Foundry & Pattern Works, Akron, O., recently has been organized by D. L. Van Buskirk, Clarence E. Kroeger and associates.

* * *

Freed Heater Co., West Third avenue, Collegeville, Pa., suffered damage to the extent $3500 to its plant on Dec. 7.

* * *

St. Paul Foundry Co., Como avenue and Mackubin street, St. Paul, Minn., recently has increased operations in its foundry, according to F. S. Power, president.

* * *

Pipe foundry of the Minnequa plant of the Colorado Fuel & Iron Co., Pueblo, Colo., recently resumed operations after being idle since the latter part of August.

* * *

Moline Iron Works, Moline, Ill., had twice the number of employes on its payroll the middle of December as at the same time in 1932, according to B. V. Nutt, vice president.

* * *

Campbell-Wyant & Cannon Foundry Co., Sanford and Broadway streets, Muskegon, Mich., added 500 employes to its payroll in December, bringing the total personnel to 1500.

* * *

James Q. Pettigrew and several former employes of the Pettigrew Foundry Co., Harvey, Ill., have organized a new foundry which now is being operated in the William E. Dee plant on 155th street, Harvey.

* * *

Columbian Iron Works, Chattanooga, Tenn., iron, brass and aluminum foundry, has been purchased by interests associated with the Mueller Co., Decatur, Ill., and immediate improvements to the former plant are expected to be made.

* * *

Zandt Brass Foundry Co., recently has moved from 412 Railroad avenue, south, to 2727 Seventh avenue, south, Seattle. John Zandt Sr. is president. Through a typographical error the name of that company was given incorrectly on page 69 of the December issue of THE FOUNDRY.

* * *

Geo. H. Lincoln Co., 191 Old Colony avenue, South Boston, Mass., recently has been taken over by the Lincoln Foundry, Inc. Herbert V. Evans, for several years general manager of the former company, is president and treasurer of the Lincoln Foundry, Inc.

* * *

Reorganization of the Independent Stove Co., Owosso, Mich., is contemplated in a plan recently submitted to the stockholders. It is also planned to change the name of the company to the Renown Stove Co., to incorporate the company's trade name.

* * *

Commercial Foundry Co., 243 Stanley street, New Britain, Conn., recently was incorporated. This company has been in operation for a number of years and specializes in brass, bronze, copper and aluminum alloy castings, as well as white metal and bronze pattern castings and aluminum match plates. The following are the officers: President, F. E. Ekwurtzel, vice president and treasurer, W. Prokop, secretary, L. Ekwurtzel.

* * *

Production and shipments of iron and steel castings in the Philadelphia Federal Reserve district decreased during November, according to a report of the Industrial Research department, University of Pennsylvania. Output of steel foundries declined to the lowest point since April, the production of gray iron castings outside

RAW MATERIAL PRICES
Jan. 8, 1934

Iron	
No. 2 foundry, Valley	$17.50
No. 2 Southern, Birmingham	13.50
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.50
Basic, Buffalo	16.50
Basic, Valley	17.00
Malleable, Chicago	17.50
Malleable, Buffalo	18.00
Coke	
Connellsville beehive coke premium	$5.00 to $5.25
Wise county beehive coke	3.50 to 4.25
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$12.00
Heavy melting steel, Pitts	$11.00 to 11.50
Heavy melting steel, Chicago	10.00 to 10.50
Stove plate, Buffalo	9.00 to 9.50
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	9.00 to 9.50
No. 1 cast, Pittsburgh	12.25 to 12.75
No. 1 cast, Philadelphia	11.50 to 12.50
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	11.00 to 11.50
Car wheels, iron, Chicago	10.50 to 11.00
Railroad malleable, Chicago	10.50 to 11.00
Malleable, Buffalo	10.50 to 11.00
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.00
Straits tin	52.00
Aluminum, No. 12, producers	19.00 to 22.00
Aluminum, No. 12 remelt Cleveland	12.00 to 12.50
Lead, New York	4.00
Antimony, New York	7.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.25

of Philadelphia and that of malleable iron castings was less than any month since May, but activity in gray iron foundries in Philadelphia was greater than in any other month since June, 1931, except October of 1933. Tonnage of unfilled orders for iron and steel castings increased during November.

Faked Foundry Facts

Rapping Plate

New Trade Publications

POLISHING GRAIN—Norton Co., Worcester, Mass., recently has published an interesting booklet entitled "The Technical Aspect of Polishing Grain." Topics discussed include the functioning of polishing grain, abrasive developments, angularity or grain shape, bonding strength, controlled sizing and factors of efficient polishing.

CENTRIFUGAL CASTINGS—Shenango-Penn Mold Co., Denver, O., has published its Bulletin No. 133 describing various uses for its centrifugal castings of bronze and other alloys.

PYROMETERS — Brown Instrument Co., Wayne and Roberts avenues, Philadelphia, has published a bulletin on its potentiometer pyrometer. A recent catalog also discusses the same subject more in detail.

TURBINE PUMP—Roots-Connersville-Wilbraham, Connersville, Ind., has published bulletin 260-B11 on regenerative turbine pumps. The text discusses the design, gives data on capacities and heads, and provides a characteristic performance curve.

ELECTRICAL EQUIPMENT — Alternating current polyphase induction motors, direct current motors, generators, motor generator sets, speed changers, flexible couplings, etc., are described and illustrated in a catalog issued by the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

WELDING — Metal & Thermit Corp., 120 Broadway, New York, has published a new booklet describing thermit welding, an alumino-thermic process employed in welding heavy sections of ferrous metal. Illustrations indicate the types of work accomplished with that process.

HANDLING EQUIPMENT—Cleveland Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., recently has issued a folder illustrating and describing various installations of its tramrail equipment. Special emphasis is placed upon features of design of the equipment, including the shape of the rail.

AIR DRYING—A device for the absorption of moisture from air and gas is described in a bulletin issued by the Pittsburgh Lectrodryer Corp., foot Thirty-second street, Pittsburgh. The unit employes activated alumina, a solid absorbant which recently was developed by the Aluminum Co. of America.

CEMENT GUNS—Cement Gun Co., Allentown, Pa., recently has published a 50 page booklet describing and illustrating its cement gun as well as numerous uses to which that equipment may be applied. It is pointed out that the gun may be used in placing refractory materials in various types of furnaces.

RECUPERATORS—Carborundum Co., Perth Amboy, N. J., has published a folder illustrating and describing the application of recuperative malleable iron air furnaces. Features claimed include a reduction in fuel costs, reduction in time of heats, improved metal characteristics, increased pulverizer capacity and better combustion.

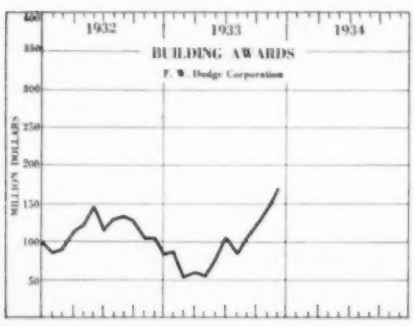
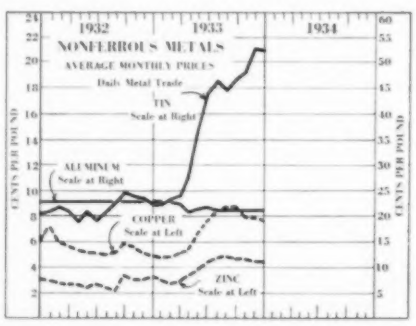
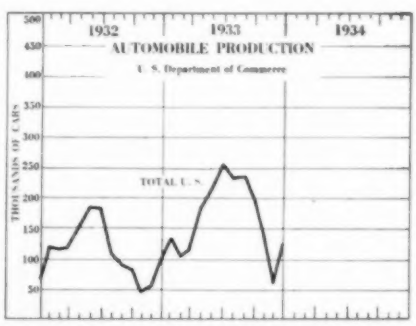
COMPRESSORS—A line of feather valve motor driven compressors is illustrated and discussed in considerable detail in a booklet recently published by the Worthington Pump & Machinery Corp., Harrison, N. J. A second bulletin describes centrifugal pumps having the pump and motor combined in one unit.

STARTING SWITCHES — General Electric Co., Schenectady, N. Y., has published a bulletin dealing with its line of motor starting switches for fractional-horsepower motors. Some of the features mentioned include complete overload protection, positive snap action mechanism, substantial construction, compactness, trip free mechanism on overload, etc.

DIE CASTINGS—New Jersey Zinc Co., 160 Front street, New York, has issued a booklet "Planning, Making, Selling—Design for Profit" which shows a wide variety of applications for die castings made of zinc. In addition to an interesting selection of photographs, sectional drawings illustrate the uses of zinc in an automobile and predict the application to the house of the future.

MOLDING MACHINE—A high speed jar rollover and pattern drawing molding machine of 1500 pounds capacity is described and illustrated in a bulletin of the Herman Pneumatic Machine Co., Union Bank building, Pittsburgh. A second bulletin by that company describes an automatic fluid timing valve which may be used to regulate the ramming operations so that molds of uniform density are provided.

SYNCHRONOUS MOTORS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a bulletin on its line of high speed synchronous motors for coupled, belted and geared service. The motors are recommended for types of constant speed machinery such as fans, blowers, compressors, pumps, etc. A new principle of built-in protection against overheating, which is included in the motor, also is discussed.

PROTECTION—A booklet on "Protection of Workers Exposed to Chromium and Its Compounds" has been published by the industrial health section, Metropolitan Life Insurance Co., 1 Madison avenue, New York. The booklet points out that the harmful effects of chromium compounds can be eliminated wholly or reduced to a minimum so that the risk becomes negligible. The responsibility is divided equally between the management and the workers.

BRONZE CASTINGS—Superheater Co., East Chicago, Ind., which recently has extended its plant and laboratory facilities under the Bronze foundry division, has published a booklet entitled "Elesco Bronze Castings." The booklet discusses standard bronzes, aluminum bronzes, high tensile manganese bronze, bushings and bearings, gears, worms, worm gears, pinions, feed nuts, acid resisting castings, etc. Illustrations show several types of castings, and views of the foundry, laboratories and machine shop.